BGY204
UHF amplifier module

Product specification
File under Discrete Semiconductors, SC09

1996 May 21
UHF amplifier module

BGY204

FEATURES

- 4.8 V nominal supply voltage
- 3.2 W output power
- Easy control of output power by DC voltage.

APPLICATIONS

- Digital cellular radio systems with Time Division Multiple Access (TDMA) operation (GSM systems) in the 880 to 915 MHz frequency range.

DESCRIPTION

The BGY204 is a four-stage UHF amplifier module in a SOT321B package. The module consists of four NPN silicon planar transistor dies mounted together with matching and bias circuit components on a metallized ceramic substrate.

QUICK REFERENCE DATA

RF performance at $T_{mb} = 25 \, ^\circ$C.

<table>
<thead>
<tr>
<th>MODE OF OPERATION</th>
<th>$f$ (MHz)</th>
<th>$V_S$ (V)</th>
<th>$V_C$ (V)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$Z_S; Z_L$ (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulsed; $\delta = 1 : 8$</td>
<td>880 to 915</td>
<td>4.8</td>
<td>$\leq 3.5$</td>
<td>3.2</td>
<td>$\geq 35$</td>
<td>typ. 45</td>
<td>50</td>
</tr>
</tbody>
</table>
### UHF amplifier module

**BGY204**

#### LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_S$</td>
<td>DC supply voltage</td>
<td>$P_L = 0$</td>
<td>–</td>
<td>8</td>
<td>V</td>
</tr>
<tr>
<td>$V_C$</td>
<td>DC control voltage</td>
<td>–</td>
<td>–</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>$P_D$</td>
<td>input drive power</td>
<td>–</td>
<td>2</td>
<td>2 mW</td>
<td></td>
</tr>
<tr>
<td>$P_L$</td>
<td>load power</td>
<td>$V_S \leq 6.5 V; Z_L = 50 \Omega$</td>
<td>–</td>
<td>4</td>
<td>W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td>–</td>
<td>–40</td>
<td>+100</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{mb}$</td>
<td>operating mounting base temperature</td>
<td>–</td>
<td>–30</td>
<td>+100</td>
<td>°C</td>
</tr>
</tbody>
</table>

#### CHARACTERISTICS

$Z_S = Z_L = 50 \Omega; P_D = 1 \text{ mW}; V_S = 4.8 \text{ V}; V_C \leq 3.5 \text{ V}; f = 880 \text{ to } 915 \text{ MHz}; T_{mb} = 25 \degree \text{ C}; \delta = 1 : 8; t_p = 575 \mu \text{s};$

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_Q$</td>
<td>leakage current</td>
<td>$V_C = 0.5 \text{ V}$</td>
<td>–</td>
<td>–</td>
<td>0.2</td>
<td>mA</td>
</tr>
<tr>
<td>$I_C$</td>
<td>control current</td>
<td>adjust $V_C$ for $P_L = 3.2 \text{ W}$</td>
<td>–</td>
<td>–</td>
<td>0.5</td>
<td>mA</td>
</tr>
<tr>
<td>$P_L$</td>
<td>load power</td>
<td>–</td>
<td>3.2</td>
<td>–</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>$G_p$</td>
<td>power gain</td>
<td>adjust $V_C$ for $P_L = 3.2 \text{ W}$</td>
<td>35</td>
<td>–</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td>$\eta$</td>
<td>efficiency</td>
<td>adjust $V_C$ for $P_L = 3.2 \text{ W}$</td>
<td>40</td>
<td>45</td>
<td>–</td>
<td>%</td>
</tr>
<tr>
<td>$H_2$</td>
<td>second harmonic</td>
<td>adjust $V_C$ for $P_L = 3.2 \text{ W}$</td>
<td>–</td>
<td>–</td>
<td>–40</td>
<td>dBc</td>
</tr>
<tr>
<td>$H_3$</td>
<td>third harmonic</td>
<td>adjust $V_C$ for $P_L = 3.2 \text{ W}$</td>
<td>–</td>
<td>–</td>
<td>–40</td>
<td>dBc</td>
</tr>
<tr>
<td>$\text{VSWR}_{in}$</td>
<td>input VSWR</td>
<td>adjust $V_C$ for $P_L = 3.2 \text{ W}$</td>
<td>–</td>
<td>–</td>
<td>2.5 : 1</td>
<td></td>
</tr>
<tr>
<td>$\text{VSWR}_{stability}$</td>
<td>stability</td>
<td>$P_D = 0.5 \text{ to } 2 \text{ mW}; V_S = 4 \text{ to } 6.5 \text{ V}; V_C = 0 \text{ to } 3.5 \text{ V}; P_L \leq 3.2 \text{ W};$</td>
<td>–</td>
<td>–</td>
<td>–60</td>
<td>dBc</td>
</tr>
<tr>
<td>$\text{isolation}$</td>
<td>–</td>
<td>$V_C = 0.5 \text{ V}$</td>
<td>–</td>
<td>–</td>
<td>–36</td>
<td>dBm</td>
</tr>
<tr>
<td>$\text{control bandwidth}$</td>
<td>–</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>$P_n$</td>
<td>noise power</td>
<td>$P_L = 3.2 \text{ W};$ bandwidth = 30 kHz; 20 MHz above transmitter band</td>
<td>–</td>
<td>–</td>
<td>–85</td>
<td>dBm</td>
</tr>
<tr>
<td>ruggedness</td>
<td>$V_S = 6.5 \text{ V};$ adjust $V_C$ for $P_L = 3.2 \text{ W};$ VSWR $\leq 10 : 1$ through all phases</td>
<td>no degradation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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Fig. 2 Load power as a function of control voltage; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, P_D = 0 \, \text{dBm}; \, V_S = 4.8 \, \text{V}; \, T_{mb} = 25 \, ^\circ \text{C}. \]

Fig. 3 Load power as a function of drive power; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, V_S = 4.8 \, \text{V}; \, \text{adjust } V_C \text{ for } P_L = 3.2 \, \text{W}; \, T_{mb} = 25 \, ^\circ \text{C}. \]

Fig. 4 Output amplitude modulation as a function of load power; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, V_S = 4.8 \, \text{V}; \, T_{mb} = 25 \, ^\circ \text{C}; \, \text{input amplitude modulation} = 3\%. \]

Fig. 5 Efficiency as a function of load power; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, V_S = 4.8 \, \text{V}; \, T_{mb} = 25 \, ^\circ \text{C}. \]
UHF amplifier module

**Fig. 6** Load power as a function of frequency; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, P_D = 0 \, \text{dBm}; \, V_S = 4.8 \, V; \, V_C = 3.5 \, V; \, T_{mb} = 25 \, ^\circ C. \]

**Fig. 7** Control voltage and harmonics as functions of frequency; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, P_D = 0 \, \text{dBm}; \, V_S = 4.8 \, V; \, P_L = 3.2 \, W; \, T_{mb} = 25 \, ^\circ C. \]

**Fig. 8** Load power as a function of the mounting base temperature; typical values.

\[ Z_S = Z_L = 50 \, \Omega; \, P_D = 0 \, \text{dBm}; \, V_S = 4.8 \, V; \, f = 900 \, \text{MHz}. \]

**Fig. 9** Control voltage as a function of mounting base temperature; typical values.

\[ P_L = 35 \, \text{dBm}; \, 30 \, \text{dBm}; \, 20 \, \text{dBm}; \, 10 \, \text{dBm}; \, 0 \, \text{dBm}. \]
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Fig. 10 Control loop voltage gain as a function of the frequency on the control pin; typical values.

\[ P_L = 30 \text{ dBm}, \quad Z_S = Z_L = 50 \Omega; \quad P_D = 0 \text{ dBm}; \quad V_S = 4.8 \text{ V}; \quad T_{mb} = 25^\circ \text{C}. \]

Fig. 11 Control loop voltage gain as a function of the frequency on the control pin; typical values.

\[ P_L = 25 \text{ dBm}, \quad Z_S = Z_L = 50 \Omega; \quad P_D = 0 \text{ dBm}; \quad V_S = 4.8 \text{ V}; \quad T_{mb} = 25^\circ \text{C}. \]

Fig. 12 Control loop voltage gain as a function of frequency on the control pin; typical values.

\[ P_L = 20 \text{ dBm}, \quad Z_S = Z_L = 50 \Omega; \quad P_D = 0 \text{ dBm}; \quad V_S = 4.8 \text{ V}; \quad T_{mb} = 25^\circ \text{C}. \]

Fig. 13 Control loop voltage gain as a function of frequency on the control pin; typical values.

\[ P_L = 15 \text{ dBm}, \quad Z_S = Z_L = 50 \Omega; \quad P_D = 0 \text{ dBm}; \quad V_S = 4.8 \text{ V}; \quad T_{mb} = 25^\circ \text{C}. \]
Fig. 14 Test circuit.

Fig. 15 Printed-circuit board layout.

Dimensions in mm.
List of components (See Fig. 14)

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
<th>CATALOGUE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C2</td>
<td>multilayer ceramic chip capacitor</td>
<td>680 pF</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>tantalum capacitor</td>
<td>2.2 μF; 35 V</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>electrolytic capacitor</td>
<td>47 μF; 40 V</td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>Grade 3B Ferroxcube bead</td>
<td></td>
<td>4330 030 36300</td>
</tr>
<tr>
<td>Z₁, Z₂</td>
<td>stripline; note 1</td>
<td>50 Ω</td>
<td></td>
</tr>
<tr>
<td>R1</td>
<td>metal film resistor</td>
<td>100 Ω; 0.4 W</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>metal film resistor</td>
<td>5 Ω; 0.4 W</td>
<td></td>
</tr>
</tbody>
</table>

Note
1. The striplines are on a double copper-clad printed-circuit board with PTFE fibreglass dielectric ($\varepsilon_r = 2.2$); thickness $\frac{1}{16}$ inch.
SOLDERING

The indicated temperatures are those at the solder interfaces.

Advised solder types are types with a liquidus less than or equal to 210 °C.

Solder dots or solder prints must be large enough to wet the contact areas.

Footprints for soldering should cover the module contact area +0.1 mm on all sides.

Soldering can be carried out using a conveyor oven, a hot air oven, an infrared oven or a combination of these ovens.

Hand soldering must be avoided because the soldering iron tip can exceed the maximum permitted temperature of 250 °C and damage the module.

The maximum temperature profile and soldering time is indicated as follows (see Fig.16):

\[
\begin{align*}
& t = 350 \text{ s at } 100 \degree C \\
& t = 300 \text{ s at } 125 \degree C \\
& t = 200 \text{ s at } 150 \degree C \\
& t = 100 \text{ s at } 175 \degree C \\
& t = 50 \text{ s at } 200 \degree C \\
& t = 5 \text{ s at } 250 \degree C \text{ (maximum temperature).}
\end{align*}
\]

Cleaning

The following fluids may be used for cleaning:

- Alcohol
- Bio-Act (Terpene Hydrocarbon)
- Triclean B/S
- Acetone.

Ultrasonic cleaning should not be used since this can cause serious damage to the product.
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PACKAGE OUTLINE

Dimensions in mm.

Fig. 17 SOT321B.
DEFINITIONS

Data sheet status

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective specification</td>
<td>This data sheet contains target or goal specifications for product development.</td>
</tr>
<tr>
<td>Preliminary specification</td>
<td>This data sheet contains preliminary data; supplementary data may be published later.</td>
</tr>
<tr>
<td>Product specification</td>
<td>This data sheet contains final product specifications.</td>
</tr>
</tbody>
</table>

Limiting values

Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information

Where application information is given, it is advisory and does not form part of the specification.

LIFE SUPPORT APPLICATIONS

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