DATA SHEET

BGY240S
UHF amplifier module

Product specification
Supersedes data of 1998 Nov 05

1999 Aug 23
UHF amplifier module  BGY240S

FEATURES
• 3.5 V nominal supply voltage
• 3 W output power
• Easy output power control by DC voltage.

APPLICATIONS
• Digital cellular radio systems with Time Division Multiple Access (TDMA) operation (GSM systems) in the 890 to 915 MHz frequency range.

DESCRIPTION
The BGY240S is a three-stage UHF amplifier module in a SOT388C package. The module consists of three NPN silicon planar transistor dies mounted together with matching and bias circuit components on a metallized ceramic substrate.

QUICK REFERENCE DATA
RF performance at $T_{mb} = 25$ °C.

<table>
<thead>
<tr>
<th>MODE OF OPERATION</th>
<th>$\text{f (MHz)}$</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>$Z_S, Z_L$ ($\Omega$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulsed; $\delta = 1 : 8$</td>
<td>890 to 915</td>
<td>3.5</td>
<td>$\leq 2.2$</td>
<td>$\geq 3$ typ. $3.5$</td>
<td>$\geq 35$</td>
<td>typ. $47$</td>
<td>50</td>
</tr>
</tbody>
</table>

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>$V_C &lt; 0.2$ V; no RF</td>
<td>7</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_C$</td>
<td>DC control voltage</td>
<td>$V_C \geq 0.2$ V</td>
<td>5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$P_D$</td>
<td>input drive power</td>
<td>--</td>
<td>3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$P_L$</td>
<td>load power</td>
<td>--</td>
<td>5</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td>--</td>
<td>3.8</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>$T_{mb}$</td>
<td>operating mounting base temperature</td>
<td>--</td>
<td>40 to +100</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION
This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A and SNW-FQ-302B.
PHILIPS SEMICONDUCTORS

UHF amplifier module

**CHARACTERISTICS**

$Z_S = Z_L = 50 \, \Omega$; $P_D = 1 \, \text{mW}$; $V_S = 3.5 \, \text{V}$; $V_C \leq 2.2 \, \text{V}$; $f = 890 \text{ to } 915 \, \text{MHz}$; $T_{mb} = 25 \, ^\circ\text{C}$; $\delta = 1 : 8$; $t_p = 575 \, \mu\text{s}$ unless otherwise specified.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ</td>
<td>leakage current</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak control current</td>
</tr>
<tr>
<td>$P_L$</td>
<td>load power</td>
</tr>
<tr>
<td>$G_p$</td>
<td>power gain</td>
</tr>
<tr>
<td>$\eta$</td>
<td>efficiency</td>
</tr>
<tr>
<td>$H_2$</td>
<td>second harmonic</td>
</tr>
<tr>
<td>$H_3$</td>
<td>third harmonic</td>
</tr>
<tr>
<td>VSWR$_{in}$</td>
<td>input VSWR</td>
</tr>
<tr>
<td>stability</td>
<td>$V_S = 3 \text{ to } 5 , \text{V}$; $P_D = -2 \text{ to } +5 , \text{dBm}$; $V_C = 0 \text{ to } 2.2 , \text{V}$; $P_L \leq 3 , \text{W}$; VSWR $\leq 12 : 1$ through all phases</td>
</tr>
<tr>
<td>isolation</td>
<td>$V_C = 0.2 , \text{V}$</td>
</tr>
<tr>
<td>$P_n$</td>
<td>noise power</td>
</tr>
<tr>
<td>AM/PM conversion</td>
<td>$P_D = -2 \text{ to } +5 , \text{dBm}$; $P_L = 6 \text{ to } 34 , \text{dBm}$</td>
</tr>
<tr>
<td>AM/AM conversion</td>
<td>$P_D$ with 3% AM; $f = 100 , \text{kHz}$; $P_L = 6 \text{ to } 34 , \text{dBm}$</td>
</tr>
<tr>
<td>$t_r$</td>
<td>carrier rise time</td>
</tr>
<tr>
<td>$t_f$</td>
<td>carrier fall time</td>
</tr>
<tr>
<td>ruggedness</td>
<td>$V_S = 5 , \text{V}$; adjust $V_C$ for $P_L = 3 , \text{W}$; VSWR $\leq 12 : 1$ through all phases</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 Ω; V_S = 3.5 V; P_D = 1 mW;
T_{mb} = 25 °C; δ = 1 : 8; t_p = 575 µs.

**Fig. 3** Load power as a function of supply voltage; typical values.

Z_S = Z_L = 50 Ω; V_C = 2.2 V; P_D = 1 mW;
T_{mb} = 25 °C; δ = 1 : 8; t_p = 575 µs.

**Fig. 4** Efficiency as a function of load power; typical values.

Z_S = Z_L = 50 Ω; V_S = 3.5 V; P_D = 1 mW;
T_{mb} = 25 °C; δ = 1 : 8; t_p = 575 µs.

**Fig. 5** Load power as a function of frequency; typical values.

Z_S = Z_L = 50 Ω; V_S = 3.5 V; P_D = 1 mW; V_C = 2.2 V;
T_{mb} = 25 °C; δ = 1 : 8; t_p = 575 µs.
UHF amplifier module  

**Fig. 6** Input VSWR as a function of load power; typical values.

- $Z_S = Z_L = 50 \, \Omega$  
- $V_S = 3.5 \, V$  
- $P_D = 1 \, mW$  
- $T_{mb} = 25 \, ^\circ C$  
- $\delta = 1 : 8$  
- $t_p = 575 \, \mu s$

**Fig. 7** Harmonics as a function of frequency; typical values.

- $Z_S = Z_L = 50 \, \Omega$  
- $V_S = 3.5 \, V$  
- $P_D = 1 \, mW$  
- $P_L = 2.5 \, W$  
- $T_{mb} = 25 \, ^\circ C$  
- $\delta = 1 : 8$  
- $t_p = 575 \, \mu s$

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

- $Z_S = Z_L = 50 \, \Omega$  
- $P_D = 1 \, mW$  
- $V_C = 2.2 \, V$  
- $\delta = 1 : 8$  
- $t_p = 575 \, \mu s$

  1. $V_S = 3.5 \, V$; $f = 880 \, MHz$.
  2. $V_S = 3.5 \, V$; $f = 915 \, MHz$.
  3. $V_S = 3.1 \, V$; $f = 880 \, MHz$.
  4. $V_S = 3.1 \, V$; $f = 915 \, MHz$.

**Fig. 9** Output amplitude modulation as a function of load power; typical values.

- $Z_S = Z_L = 50 \, \Omega$  
- $V_S = 3.5 \, V$  
- $P_D = 1 \, mW$  
- $T_{mb} = 25 \, ^\circ C$  
- $\Delta f = 100 \, kHz$  
- Input amplitude modulation = 3%  
- $\delta = 1 : 8$  
- $t_p = 575 \, \mu s$
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Fig.10  Printed-circuit board test fixture.

Dimensions in mm.

Fig.11  Test circuit.
List of components (see Fig.11)

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
<th>DIMENSIONS</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>
<td>2222 851 11681</td>
</tr>
<tr>
<td>C3</td>
<td>tantalum capacitor</td>
<td>2.2 µF; 35 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>electrolytic capacitor</td>
<td>47 µF; 40 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>Grade 4S2 Ferroxcube bead</td>
<td>50 Ω</td>
<td>width 2.33 mm</td>
<td>4330 030 36300</td>
</tr>
<tr>
<td>Z1, Z2</td>
<td>stripline; note 1</td>
<td>50 Ω</td>
<td>width 2.33 mm</td>
<td></td>
</tr>
<tr>
<td>R1</td>
<td>metal film resistor</td>
<td>100 Ω; 0.6 W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**

1. The striplines are on a double copper-clad printed-circuit board with PTFE fibreglass dielectric ($\epsilon_r = 2.2$); thickness $\frac{1}{32}$ 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.

Soldering can be carried out using a conveyor oven, a hot air oven, an infrared oven or a combination of these ovens. A double reflow process is permitted.

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 allowed temperature is 250 °C for a maximum of 5 seconds.

The maximum ramp-up is 10 °C per second.

The maximum cool-down is 5 °C per second.

Cleaning

The following fluids may be used for cleaning:

- Alcohol
- Bio-Act (Terpene Hydrocarbon)
- Acetone.

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

Fig.12  Recommended reflow temperature profile.
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Fig. 13  Footprint SOT388C.

Dimensions in mm.

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PACKAGE OUTLINE

Rectangular single-ended surface-mount package; metal cap; 4 in-line leads

SOT388C

DIMENSIONS (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>b</th>
<th>c</th>
<th>D</th>
<th>e</th>
<th>e₁</th>
<th>E</th>
<th>L</th>
<th>L₁</th>
<th>U</th>
<th>U₁</th>
<th>w</th>
<th>y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>2.7</td>
<td>0.56</td>
<td>0.30</td>
<td>17.1</td>
<td>5.08</td>
<td>2.54</td>
<td>12.2</td>
<td>0.7</td>
<td>3.4</td>
<td>17.3</td>
<td>6.0</td>
<td>0.25</td>
<td>0.15</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>0.46</td>
<td>0.20</td>
<td>16.7</td>
<td></td>
<td></td>
<td>11.8</td>
<td>0.3</td>
<td>3.0</td>
<td>16.9</td>
<td>5.6</td>
<td></td>
<td></td>
<td>1.9</td>
</tr>
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</table>

OUTLINE VERSION

<table>
<thead>
<tr>
<th>REFERENCES</th>
<th>EUROPEAN PROJECTION</th>
<th>ISSUE DATE</th>
</tr>
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<tbody>
<tr>
<td>IEC</td>
<td>JEDEC</td>
<td>EIAJ</td>
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<td>SOT388C</td>
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<td>99-02-06</td>
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</table>
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**BGY240S**

## DEFINITIONS

### Data Sheet Status

<table>
<thead>
<tr>
<th>Data Sheet 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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.