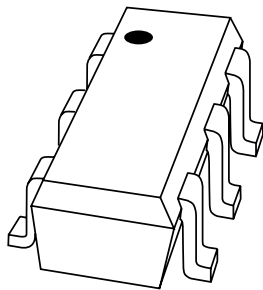


# DATA SHEET



## **BGA2012** 1900 MHz high linear low noise amplifier

Product specification  
Supersedes data of 2000 Sep 06

2000 Dec 04

# 1900 MHz high linear low noise amplifier

# BGA2012

### FEATURES

- Low current, low voltage
- High linearity
- High power gain
- Low noise
- Integrated temperature compensated biasing
- Control pin for adjustment bias current.

### APPLICATIONS

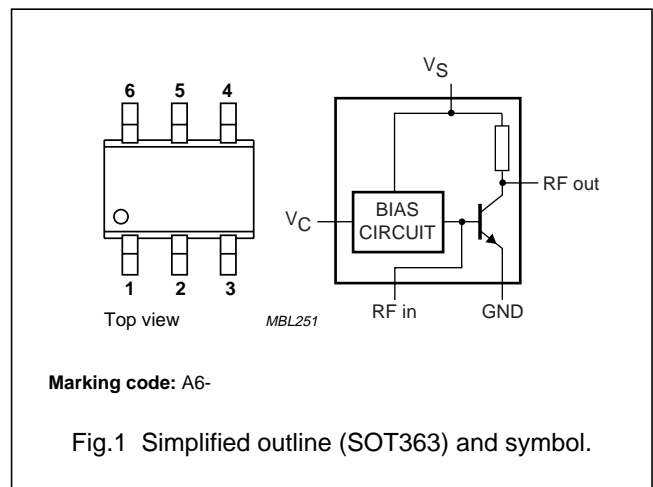
- RF front end
- Low noise amplifiers, e.g. CDMA, PHs, Dect, etc.

### DESCRIPTION

Silicon Monolithic Microwave Integrated Circuit (MMIC) amplifier consisting of an NPN double polysilicon transistor with integrated biasing for low voltage applications in a 6-pin SOT363 plastic SMD package.

### PINNING

| PIN  | DESCRIPTION    |
|------|----------------|
| 1    | RF in          |
| 2    | V <sub>C</sub> |
| 3    | V <sub>S</sub> |
| 4    | RF out         |
| 5, 6 | GND            |



### QUICK REFERENCE DATA

| SYMBOL                         | PARAMETER            | CONDITIONS   | TYP. | MAX. | UNIT |
|--------------------------------|----------------------|--|------|------|------|
| V <sub>S</sub>                 | DC supply voltage    | RF input AC coupled                                | 3    | 4.5  | V    |
| I <sub>S</sub>                 | DC supply current    |  | 7.5  | –    | mA   |
| I <sub>C</sub>                 | DC control current   | V <sub>C</sub> = V <sub>S</sub>                    | 0.11 | –    | mA   |
| S <sub>21</sub>   <sup>2</sup> | insertion power gain | in application circuit, see Fig.2;<br>f = 1900 MHz | 16   | –    | dB   |
| NF                             | noise figure         | I <sub>S</sub> = 7 mA; f = 1900 MHz                | 1.7  | –    | dB   |

### LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134)

| SYMBOL           | PARAMETER                      | CONDITIONS                       | MIN. | MAX.           | UNIT |
|------------------|--------------------------------|----------------------------------|------|----------------|------|
| V <sub>S</sub>   | DC supply voltage              | RF input AC coupled              | –    | 4.5            | V    |
| V <sub>C</sub>   | voltage on control pin         |                                  | –    | V <sub>S</sub> | V    |
| I <sub>S</sub>   | supply current                 | forced by DC voltage on RF input | –    | 15             | mA   |
| I <sub>C</sub>   | control current                |                                  | –    | 0.25           | mA   |
| P <sub>tot</sub> | total power dissipation        | T <sub>S</sub> ≤ 100 °C          | –    | 70             | mW   |
| T <sub>stg</sub> | storage temperature            |                                  | –65  | +150           | °C   |
| T <sub>j</sub>   | operating junction temperature |                                  | –    | 150            | °C   |

## 1900 MHz high linear low noise amplifier

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## THERMAL CHARACTERISTICS

| SYMBOL        | PARAMETER  | CONDITIONS   | VALUE | UNIT |
|---------------|--|--|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to solder point | $P_{tot} = 135\text{ mW}$ ; $T_s \leq 100\text{ }^\circ\text{C}$ | 350   | K/W  |

## CHARACTERISTICS

RF input AC coupled;  $V_S = 3\text{ V}$ ;  $I_S = 7\text{ mA}$ ;  $f = 1900\text{ MHz}$ ;  $T_j = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

| SYMBOL       | PARAMETER             | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |
|--------------|-----------------------|---|------|------|------|------|
| $I_S$        | supply current        |   | 5    | 7.5  | 10   | mA   |
| $I_C$        | control current       |   | –    | 0.11 | –    | mA   |
| $R_{L\ IN}$  | return losses input   | typical application; see Fig.2                      | –    | –11  | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0 mm)              | –    | –20  | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0.5 mm)            | –    | –14  | –    | dB   |
| $R_{L\ OUT}$ | return losses output  | typical application; see Fig.2                      | –    | –9   | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0 mm)              | –    | –10  | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0.5 mm)            | –    | –8   | –    | dB   |
| $ S_{21} ^2$ | insertion power gain  | typical application (see Fig.2)                     | –    | 14   | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0 mm)              | –    | 16   | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0.5 mm)            | –    | 14   | –    | dB   |
| NF           | noise figure          | typical application; see Fig.2; $I_S = 7\text{ mA}$ | –    | 1.7  | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0 mm)              | –    | 2.2  | –    | dB   |
|              |                       | high IP3 (see Fig.2; stripline = 0.5 mm)            | –    | 2.3  | –    | dB   |
| $IP_{3\ in}$ | input intercept point | typical application; see Fig.2                      | –    | –7   | –    | dBm  |
|              |                       | high IP3 (see Fig.2; stripline = 0 mm)              | –    | 7    | –    | dBm  |
|              |                       | high IP3 (see Fig.2; stripline = 0.5 mm)            | –    | 10   | –    | dBm  |

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APPLICATION INFORMATION

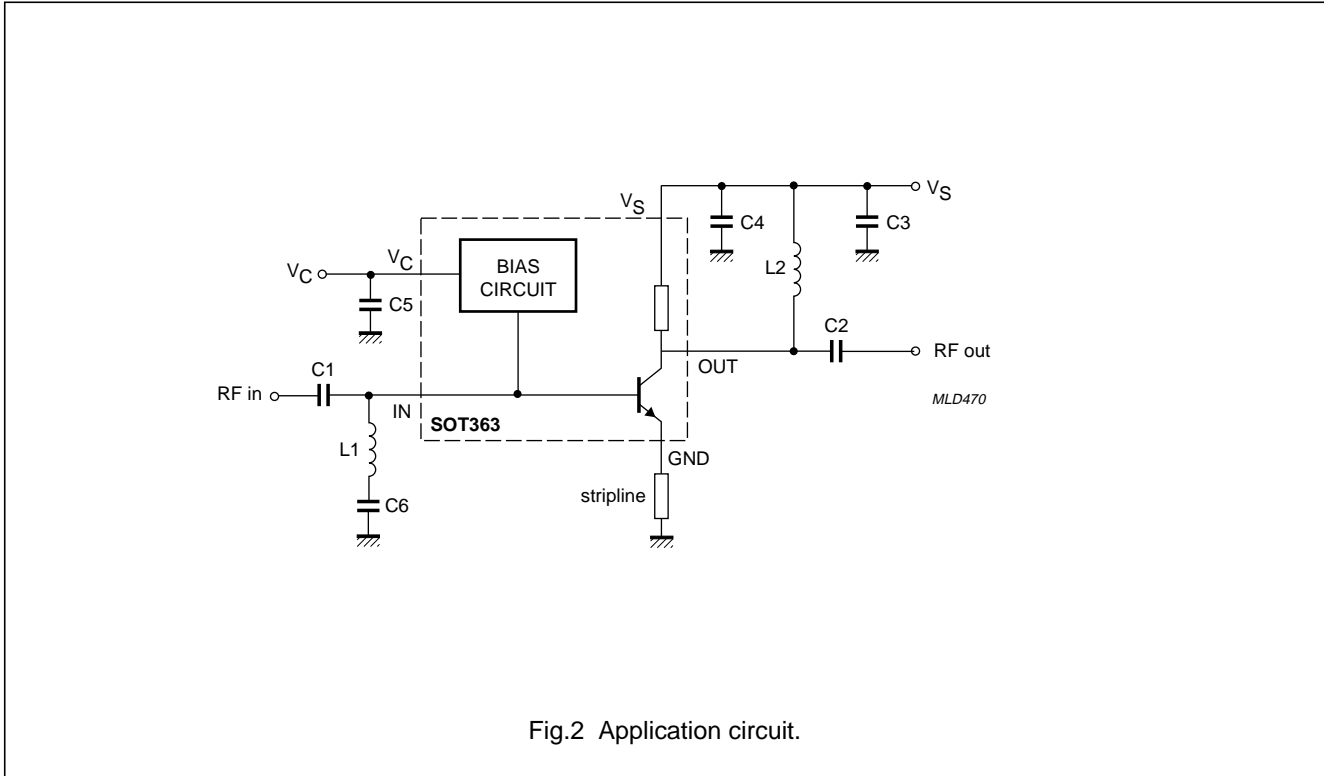


Fig.2 Application circuit.

List of components (see Fig.2)

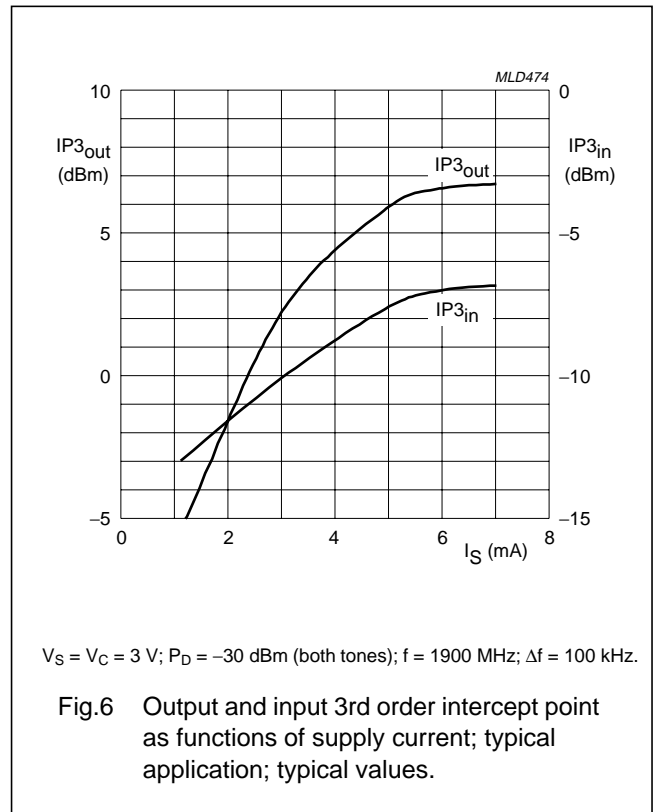
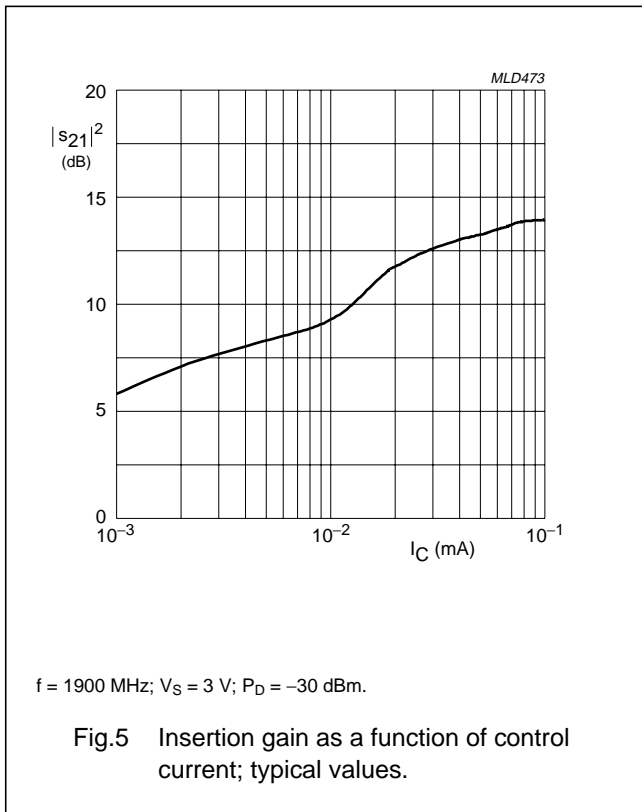
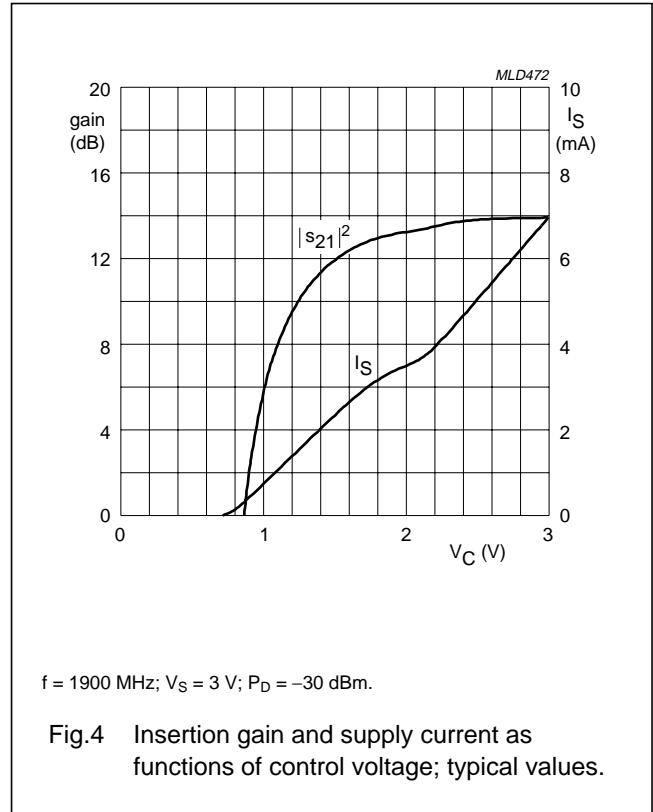
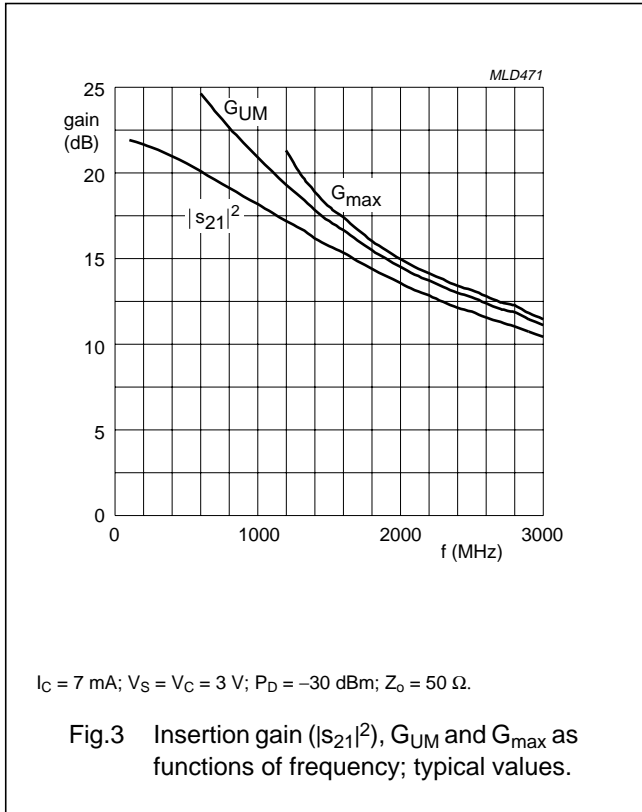
| COMPONENT | DESCRIPTION                       | TYPICAL APPLICATION | HIGH IP3 APPLICATION | DIMENSIONS |
|-----------|-----------------------------------|---------------------|----------------------|------------|
| C1, C2    | multilayer ceramic chip capacitor | 100 pF              | 100 pF               | 0603       |
| C3, C5    | multilayer ceramic chip capacitor | 22 nF               | 22 nF                | 0603       |
| C4        | multilayer ceramic chip capacitor | –                   | –                    | –          |
| C6        | multilayer ceramic chip capacitor | –                   | 100 nF               | 0805       |
| L1        | SMD inductor                      | –                   | 3.9 nH               | 0603       |
| L2        | SMD inductor                      | –                   | 3.9 nH               | 0603       |

Note

- The stripline (w = 0.7 mm) is on a gold plated double copper-clad printed-circuit board ( $\epsilon_r = 6.15$ ), board thickness = 0.64 mm, copper thickness = 35  $\mu\text{m}$ , gold thickness = 5  $\mu\text{m}$ .

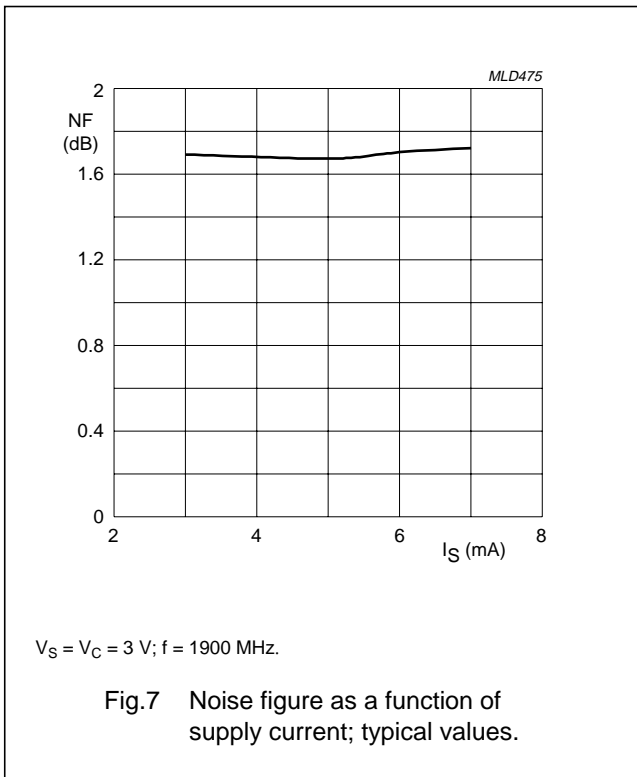
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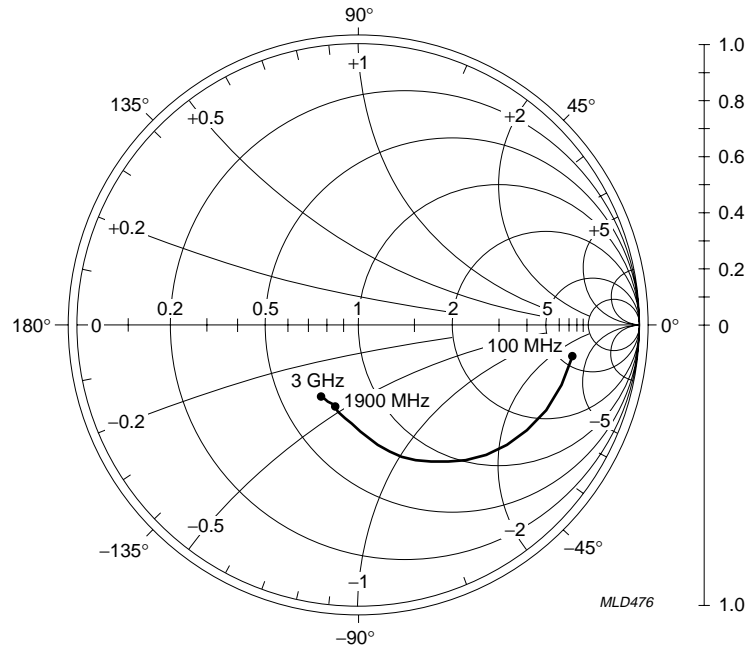
Scattering parameters

$V_S = V_C = 3\text{ V}; P_D = -30\text{ dBm}; Z_0 = 50\ \Omega; T_{\text{amb}} = 25\text{ }^\circ\text{C}$

| f (MHz) | S <sub>11</sub>   |             | S <sub>21</sub>   |             | S <sub>12</sub>   |             | S <sub>22</sub>   |             |
|---------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|
|         | MAGNITUDE (ratio) | ANGLE (deg) | MAGNITUDE (ratio) | ANGLE (deg) | MAGNITUDE (ratio) | ANGLE (deg) | MAGNITUDE (ratio) | ANGLE (deg) |
| 100     | 0.775             | -8.390      | 12.527            | 171.1       | 0.005             | 84.90       | 0.742             | -6.684      |
| 200     | 0.761             | -16.37      | 12.154            | 163.1       | 0.011             | 79.39       | 0.731             | -13.15      |
| 400     | 0.709             | -31.51      | 11.213            | 148.6       | 0.020             | 72.23       | 0.689             | -24.85      |
| 600     | 0.646             | -44.97      | 10.139            | 136.4       | 0.028             | 66.03       | 0.631             | -34.90      |
| 800     | 0.581             | -56.47      | 9.061             | 126.1       | 0.034             | 61.82       | 0.573             | -43.40      |
| 1000    | 0.519             | -66.59      | 8.131             | 117.3       | 0.039             | 58.86       | 0.519             | -50.54      |
| 1200    | 0.461             | -75.41      | 7.254             | 109.5       | 0.043             | 58.07       | 0.469             | -57.19      |
| 1400    | 0.401             | -83.99      | 6.461             | 103.1       | 0.047             | 57.92       | 0.428             | -64.08      |
| 1600    | 0.350             | -93.12      | 5.869             | 96.39       | 0.051             | 57.26       | 0.396             | -70.03      |
| 1800    | 0.313             | -102.0      | 5.256             | 90.46       | 0.054             | 57.37       | 0.369             | -75.33      |
| 2000    | 0.289             | -110.6      | 4.778             | 85.58       | 0.058             | 58.10       | 0.348             | -80.47      |
| 2200    | 0.278             | -118.5      | 4.394             | 81.16       | 0.062             | 57.66       | 0.336             | -85.37      |
| 2400    | 0.276             | -125.0      | 4.051             | 77.28       | 0.066             | 56.08       | 0.333             | -89.83      |
| 2600    | 0.286             | -131.9      | 3.793             | 74.34       | 0.072             | 60.98       | 0.316             | -92.61      |
| 2800    | 0.293             | -136.5      | 3.571             | 70.27       | 0.076             | 60.21       | 0.308             | -94.44      |
| 3000    | 0.287             | -141.6      | 3.326             | 67.39       | 0.083             | 61.36       | 0.272             | -99.52      |

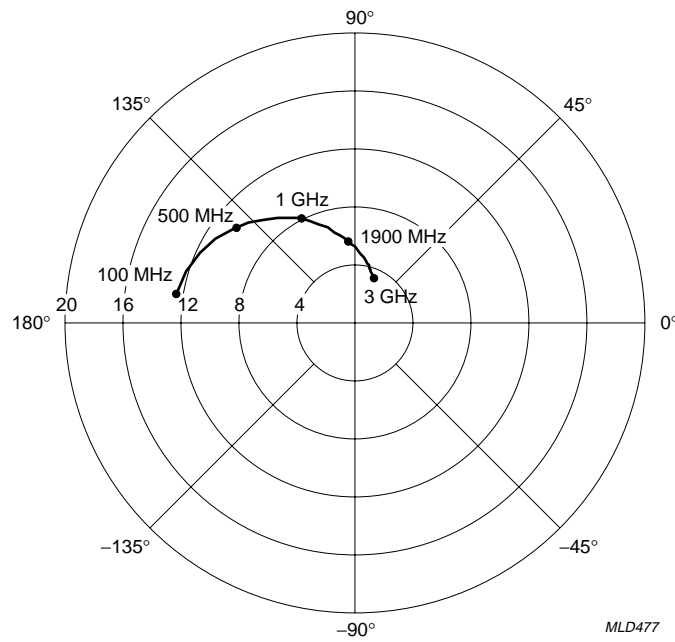
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$I_C = 7 \text{ mA}$ ;  $V_S = V_C = 3 \text{ V}$ ;  $P_D = -30 \text{ dBm}$ ;  $Z_0 = 50 \Omega$ .

Fig.8 Common emitter input reflection coefficient ( $s_{11}$ ); typical values.

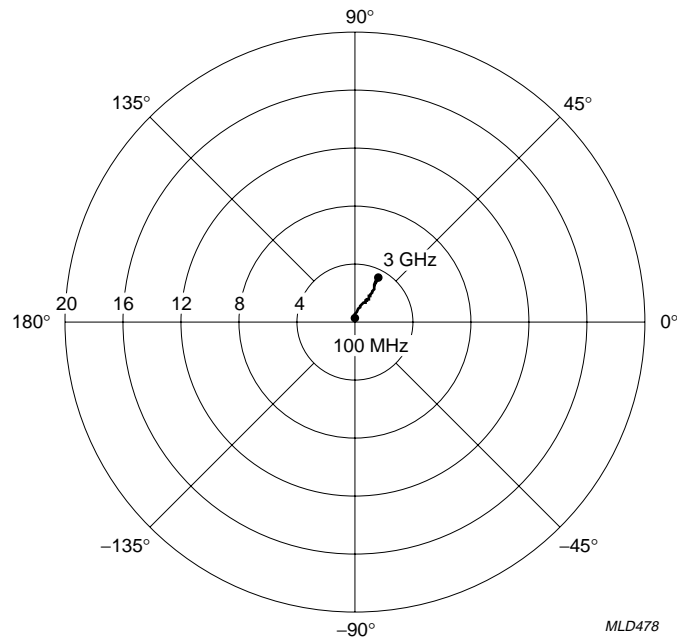


$I_C = 7 \text{ mA}$ ;  $V_S = V_C = 3 \text{ V}$ ;  $P_D = -30 \text{ dBm}$ ;  $Z_0 = 50 \Omega$ .

Fig.9 Common emitter forward transmission coefficient ( $s_{21}$ ); typical values.

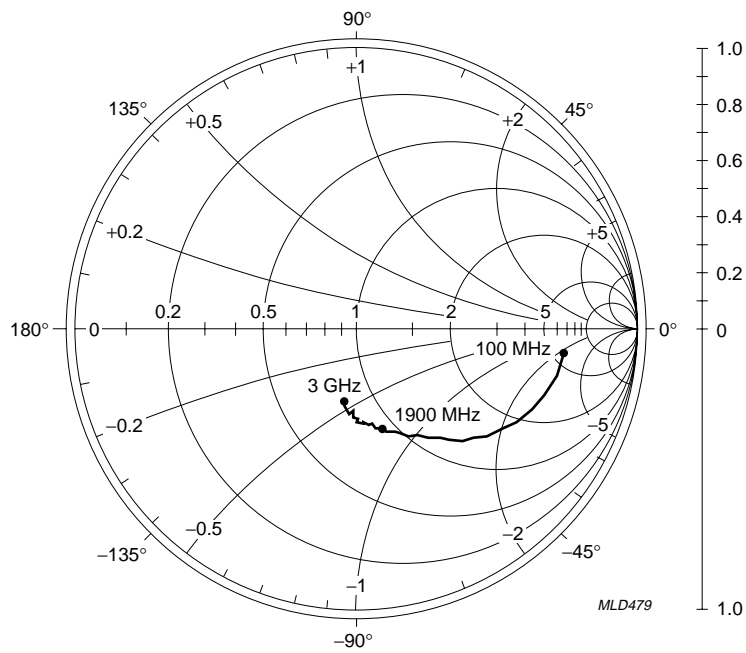
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$I_C = 7 \text{ mA}; V_S = V_C = 3 \text{ V}; P_D = -30 \text{ dBm}; Z_0 = 50 \Omega.$

Fig.10 Common emitter reverse transmission coefficient ( $s_{12}$ ); typical values.



$I_C = 7 \text{ mA}; V_S = V_C = 3 \text{ V}; P_D = -30 \text{ dBm}; Z_0 = 50 \Omega.$

Fig.11 Common emitter output reflection coefficient ( $s_{22}$ ); typical values.



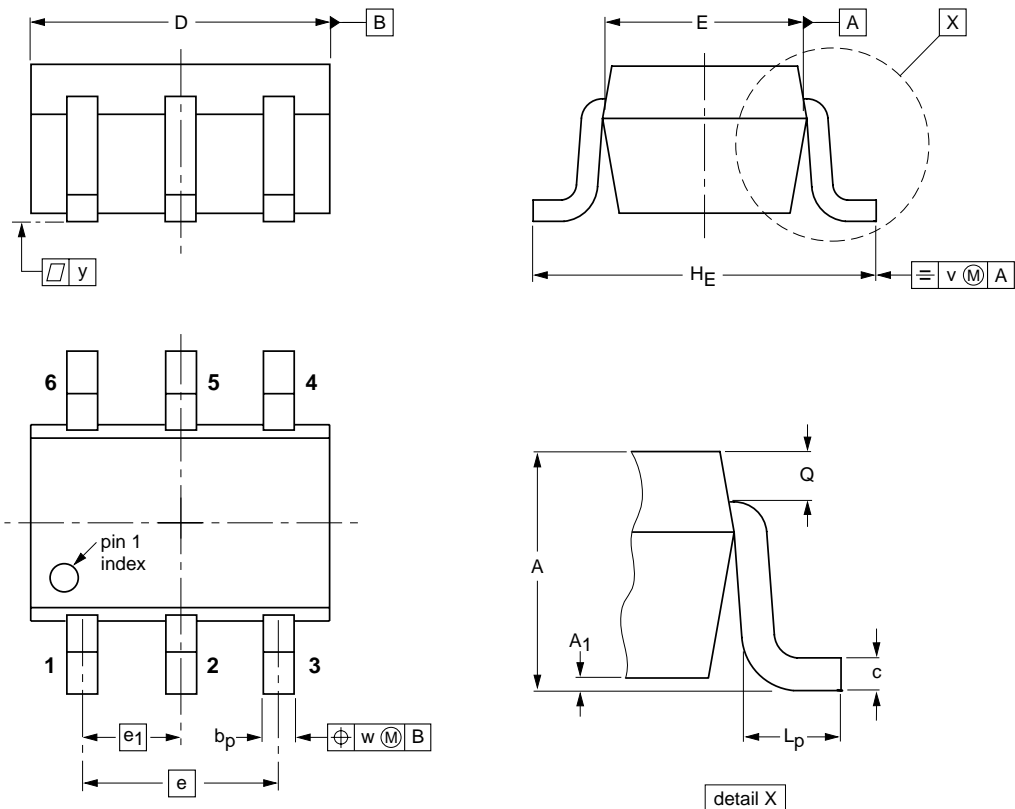
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PACKAGE OUTLINE

Plastic surface mounted package; 6 leads

SOT363



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max | b <sub>p</sub> | c            | D          | E            | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | Q            | v   | w   | y   |
|------|------------|-----------------------|----------------|--------------|------------|--------------|-----|----------------|----------------|----------------|--------------|-----|-----|-----|
| mm   | 1.1<br>0.8 | 0.1                   | 0.30<br>0.20   | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 0.65           | 2.2<br>2.0     | 0.45<br>0.15   | 0.25<br>0.15 | 0.2 | 0.2 | 0.1 |

| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE |
|--------------------|------------|-------|-------|--|------------------------|------------|
|                    | IEC        | JEDEC | EIAJ  |  |                        |            |
| SOT363             |            |       | SC-88 |  |                        | 97-02-28   |

## 1900 MHz high linear low noise amplifier

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## DATA SHEET STATUS

| DATA SHEET STATUS         | PRODUCT STATUS | DEFINITIONS <sup>(1)</sup>   |
|---------------------------|----------------|--|
| Objective specification   | Development    | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.  |
| Preliminary specification | Qualification  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
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## Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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Printed in The Netherlands

613516/02/pp12

Date of release: 2000 Dec 04

Document order number: 9397 750 07679

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