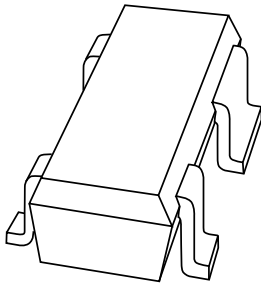


# DATA SHEET



## **BGA2001** Silicon MMIC amplifier

Product specification  
Supersedes data of 1999 Jul 23

1999 Aug 11



# Silicon MMIC amplifier

# BGA2001

## FEATURES

- Low current, low voltage
- Very high power gain
- Low noise figure
- Integrated temperature compensated biasing
- Supply and RF output pin combined.

## APPLICATIONS

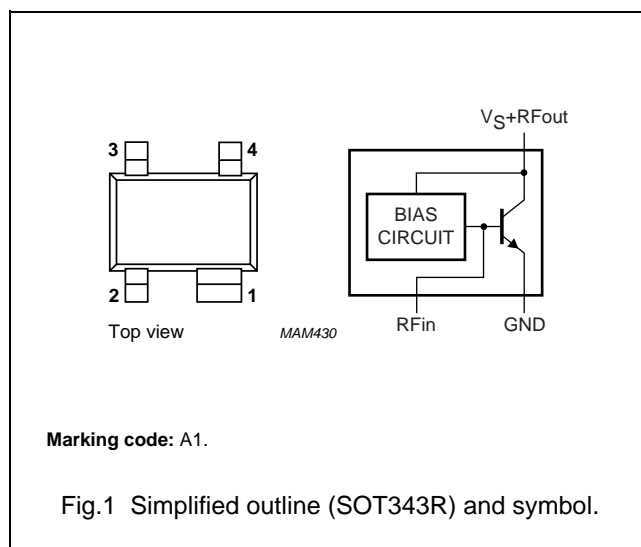
- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Radar detectors
- Low noise amplifiers
- Satellite television tuners (SATV)
- High frequency oscillators.

## DESCRIPTION

Silicon MMIC amplifier consisting of an NPN double polysilicon transistor with integrated biasing for low voltage applications in a plastic, 4-pin dual-emitter SOT343R package.

## PINNING

| PIN | DESCRIPTION            |
|-----|------------------------|
| 1   | GND                    |
| 2   | RF in                  |
| 3   | GND                    |
| 4   | V <sub>S</sub> + RFout |



## QUICK REFERENCE DATA

| SYMBOL         | PARAMETER           | CONDITIONS   | TYP. | MAX. | UNIT |
|----------------|---------------------|--|------|------|------|
| V <sub>S</sub> | DC supply voltage   | RF input AC coupled  | –    | 4.5  | V    |
| I <sub>S</sub> | DC supply current   | V <sub>V<sub>S</sub>-OUT</sub> = 2.5 V; RF input AC coupled                            | 4.5  | –    | mA   |
| MSG            | maximum stable gain | V <sub>V<sub>S</sub>-OUT</sub> = 2.5 V; f = 1.8 GHz;<br>T <sub>amb</sub> = 25 °C       | 19.5 | –    | dB   |
| NF             | noise figure        | V <sub>V<sub>S</sub>-OUT</sub> = 2.5 V; f = 1.8 GHz; Γ <sub>S</sub> = Γ <sub>opt</sub> | 1.3  | –    | dB   |

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**LIMITING VALUES**

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

| SYMBOL    | PARAMETER                      | CONDITIONS                       | MIN. | MAX. | UNIT |
|-----------|--------------------------------|----------------------------------|------|------|------|
| $V_S$     | supply voltage                 | RF input AC coupled              | –    | 4.5  | V    |
| $I_S$     | supply current (DC)            | forced by DC voltage on RF input | –    | 30   | mA   |
| $P_{tot}$ | total power dissipation        | $T_s \leq 100\text{ °C}$         | –    | 135  | mW   |
| $T_{stg}$ | storage temperature            |                                  | –65  | +150 | °C   |
| $T_j$     | operating junction temperature |                                  | –    | 150  | °C   |

**THERMAL CHARACTERISTICS**

| SYMBOL        | PARAMETER   | VALUE | UNIT |
|---------------|---|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | 350   | K/W  |

**CHARACTERISTICS**RF input AC coupled;  $T_j = 25\text{ °C}$ ; unless otherwise specified.

| SYMBOL              | PARAMETER                     | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |
|---------------------|-------------------------------|---|------|------|------|------|
| $I_S$               | supply current                | $V_{VS-OUT} = 1\text{ V}$   | –    | 0.7  | –    | mA   |
|                     |                               | $V_{VS-OUT} = 2.5\text{ V}$   | 3    | 4.5  | 6    | mA   |
|                     |                               | $V_{VS-OUT} = 4.5\text{ V}$   | –    | 11   | –    | mA   |
| MSG                 | maximum stable gain           | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4\text{ mA}$ ; $f = 900\text{ MHz}$  | –    | 22   | –    | dB   |
|                     |                               | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4\text{ mA}$ ; $f = 1.8\text{ GHz}$  | –    | 19.5 | –    | dB   |
| $ s_{21} ^2$        | insertion power gain          | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4\text{ mA}$ ; $f = 900\text{ MHz}$  | –    | 18   | –    | dB   |
|                     |                               | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4\text{ mA}$ ; $f = 1.8\text{ GHz}$  | –    | 14   | –    | dB   |
| $P_L$               | load power                    | at 1 dB gain compression point;<br>$V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4.4\text{ mA}$ ; $f = 900\text{ MHz}$ ; | –    | –2   | –    | dBm  |
| NF                  | noise figure                  | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4\text{ mA}$ ; $f = 900\text{ MHz}$ ;<br>$\Gamma_S = \Gamma_{opt}$         | –    | 1.3  | –    | dB   |
|                     |                               | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4\text{ mA}$ ; $f = 1.8\text{ GHz}$ ;<br>$\Gamma_S = \Gamma_{opt}$         | –    | 1.3  | –    | dB   |
| IP3 <sub>(in)</sub> | input intercept point; note 1 | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4.4\text{ mA}$ ; $f = 900\text{ MHz}$                                      | –    | –7.4 | –    | dBm  |
|                     |                               | $V_{VS-OUT} = 2.5\text{ V}$ ;<br>$I_{VS-OUT} = 4.5\text{ mA}$ ; $f = 1800\text{ MHz}$                                     | –    | –4.5 | –    | dBm  |

**Note**

1. See application note: RNR-T45-99-B-0513.

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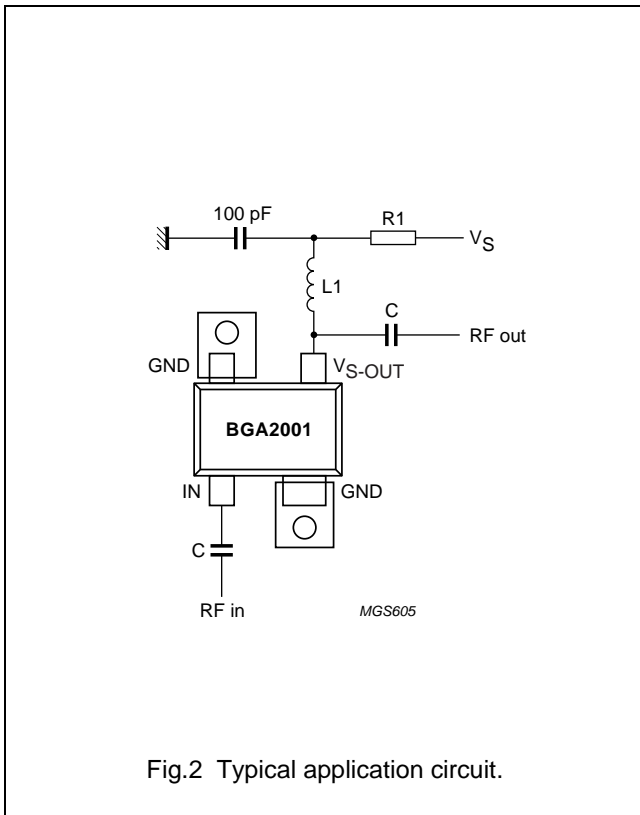


Fig.2 Typical application circuit.

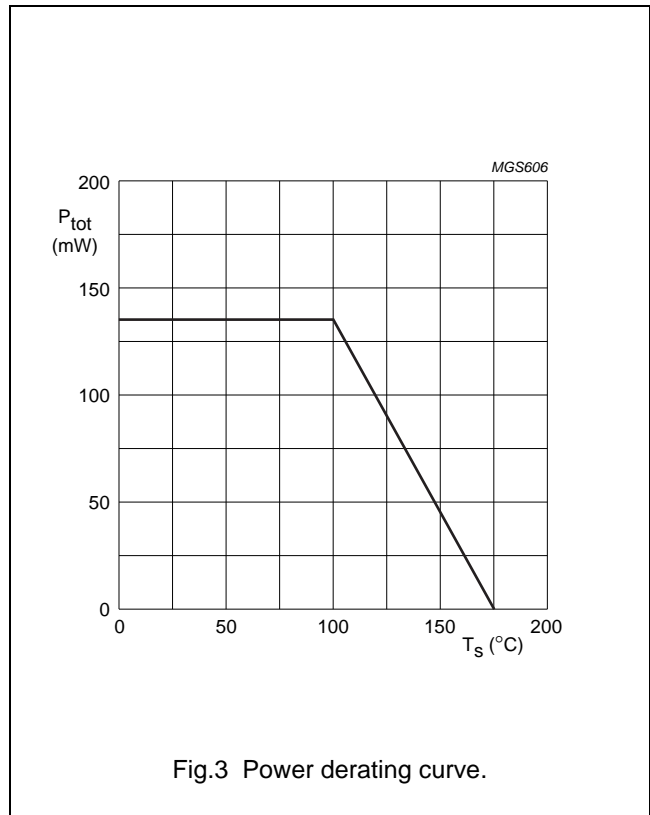


Fig.3 Power derating curve.

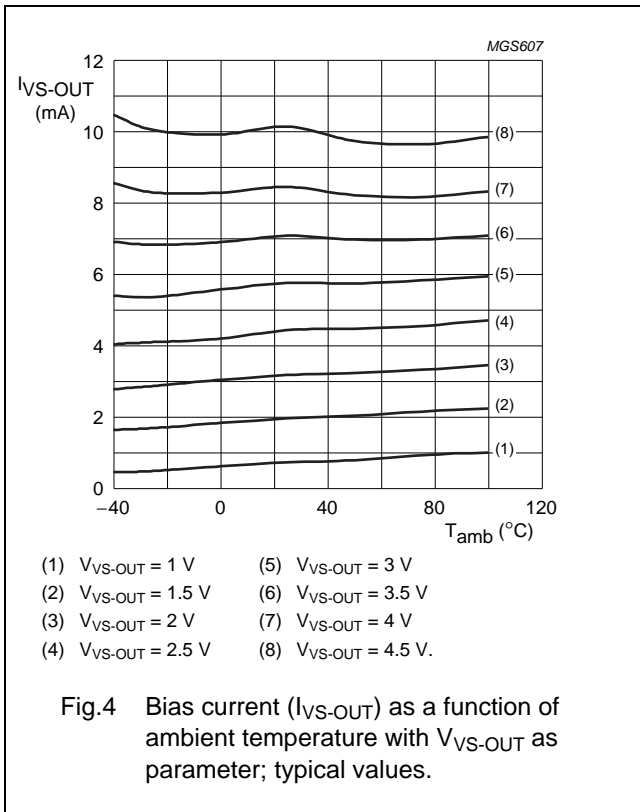


Fig.4 Bias current ( $I_{VS-OUT}$ ) as a function of ambient temperature with  $V_{VS-OUT}$  as parameter; typical values.

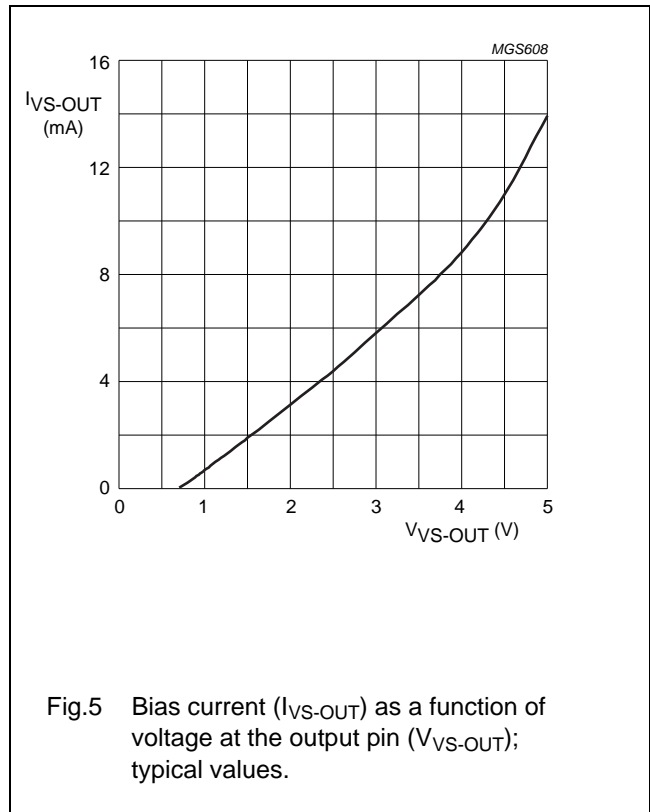
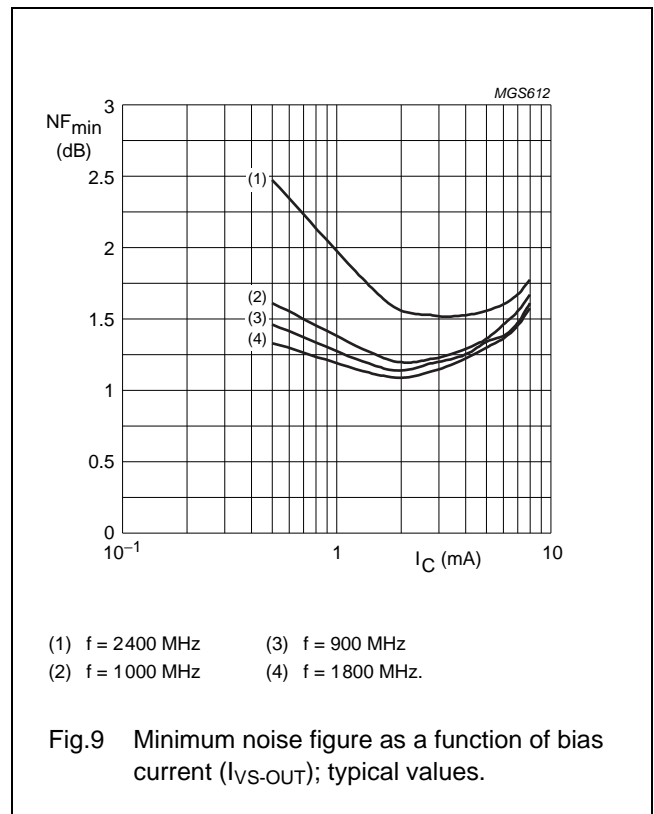
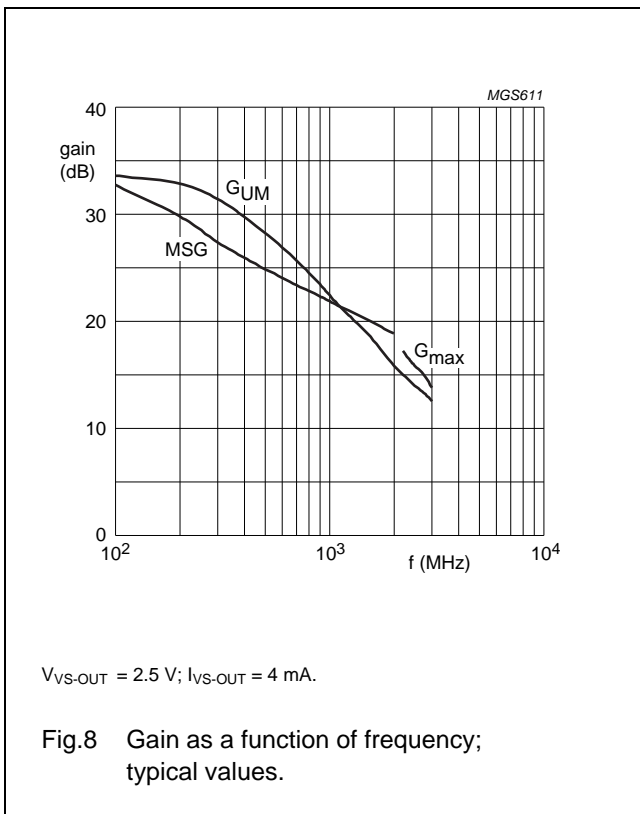
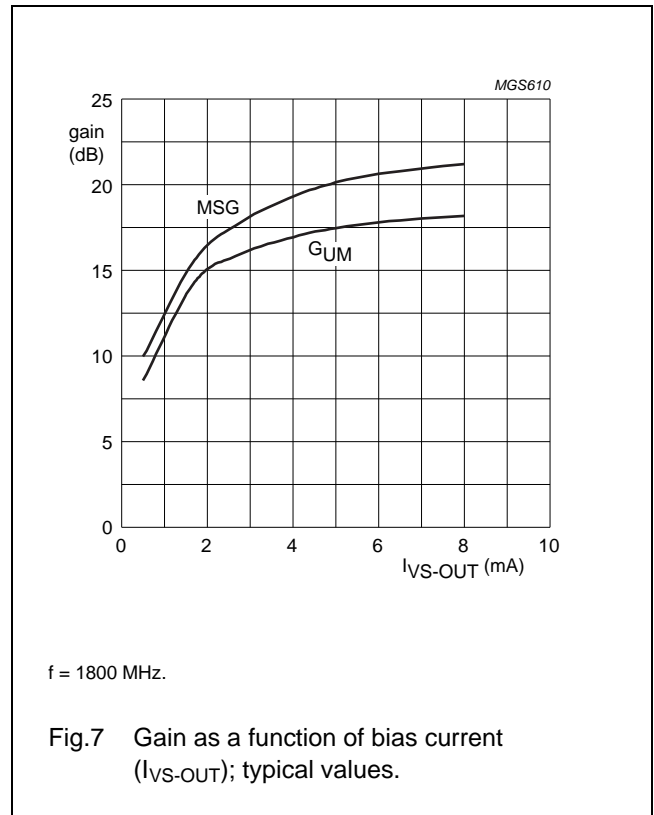
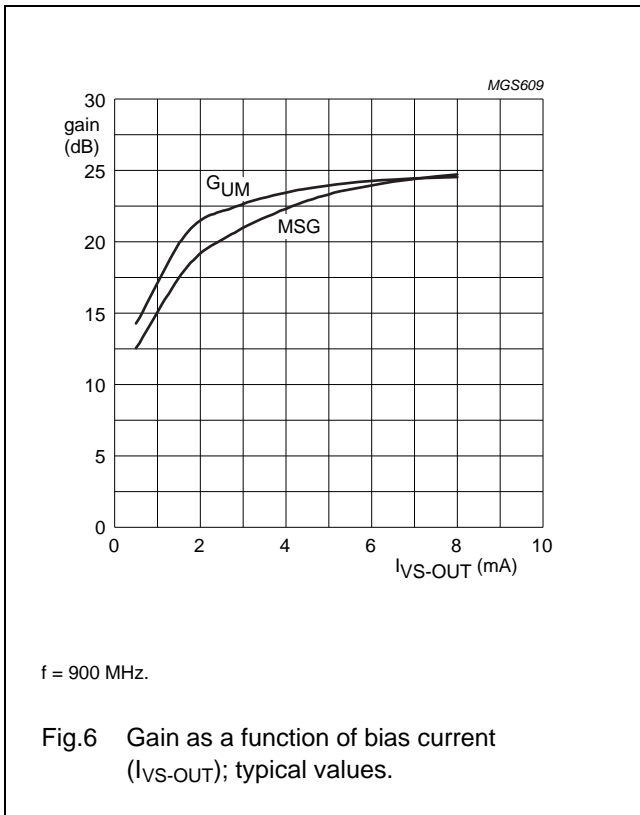


Fig.5 Bias current ( $I_{VS-OUT}$ ) as a function of voltage at the output pin ( $V_{VS-OUT}$ ); typical values.

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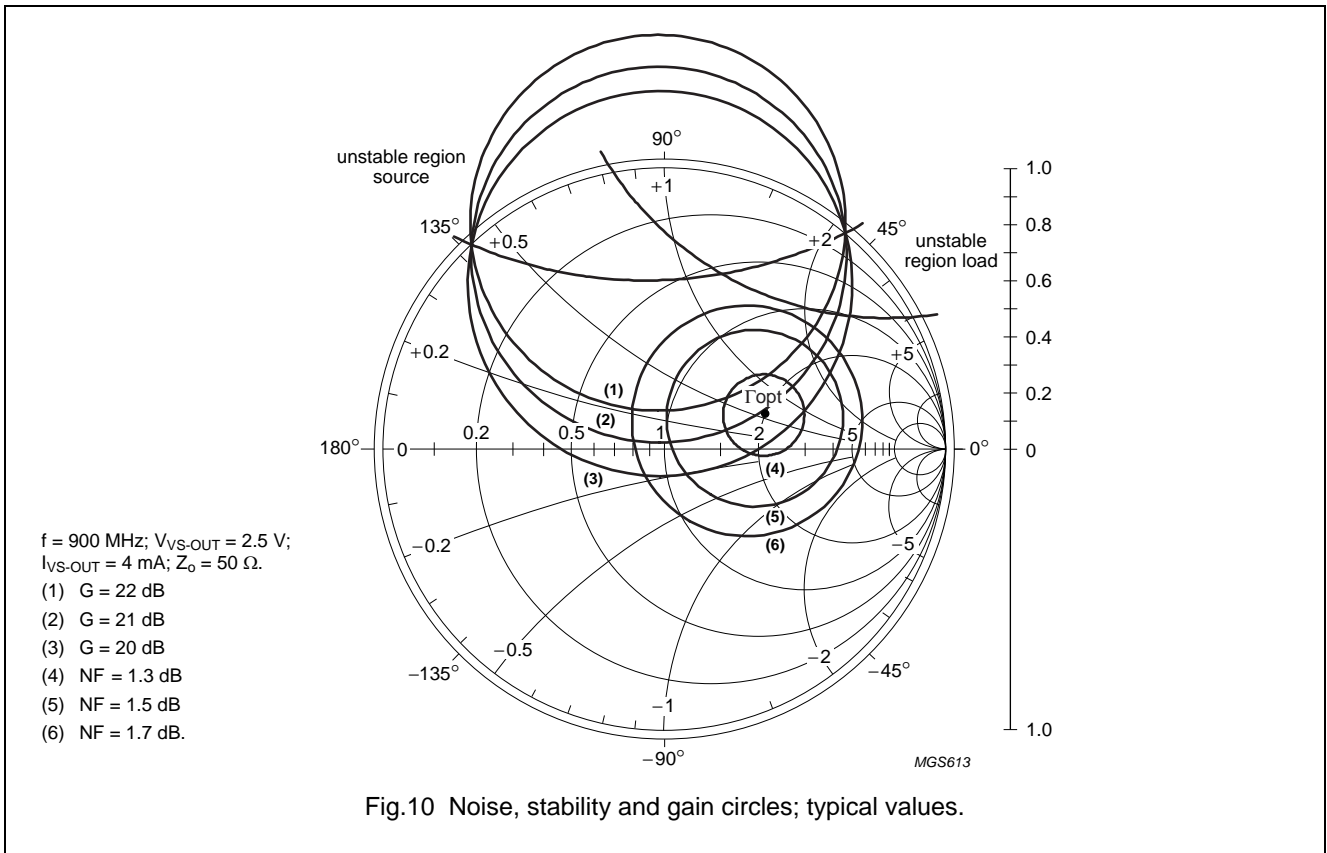


Fig.10 Noise, stability and gain circles; typical values.

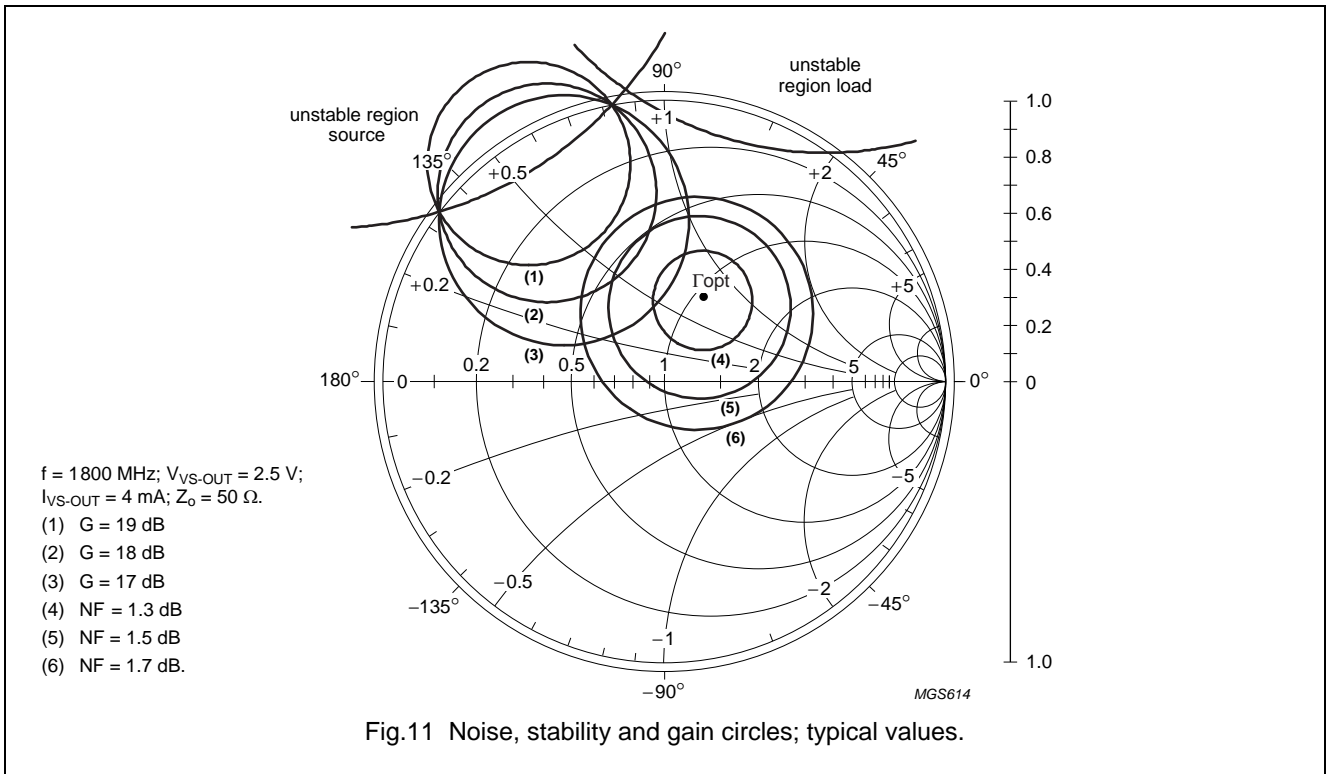


Fig.11 Noise, stability and gain circles; typical values.

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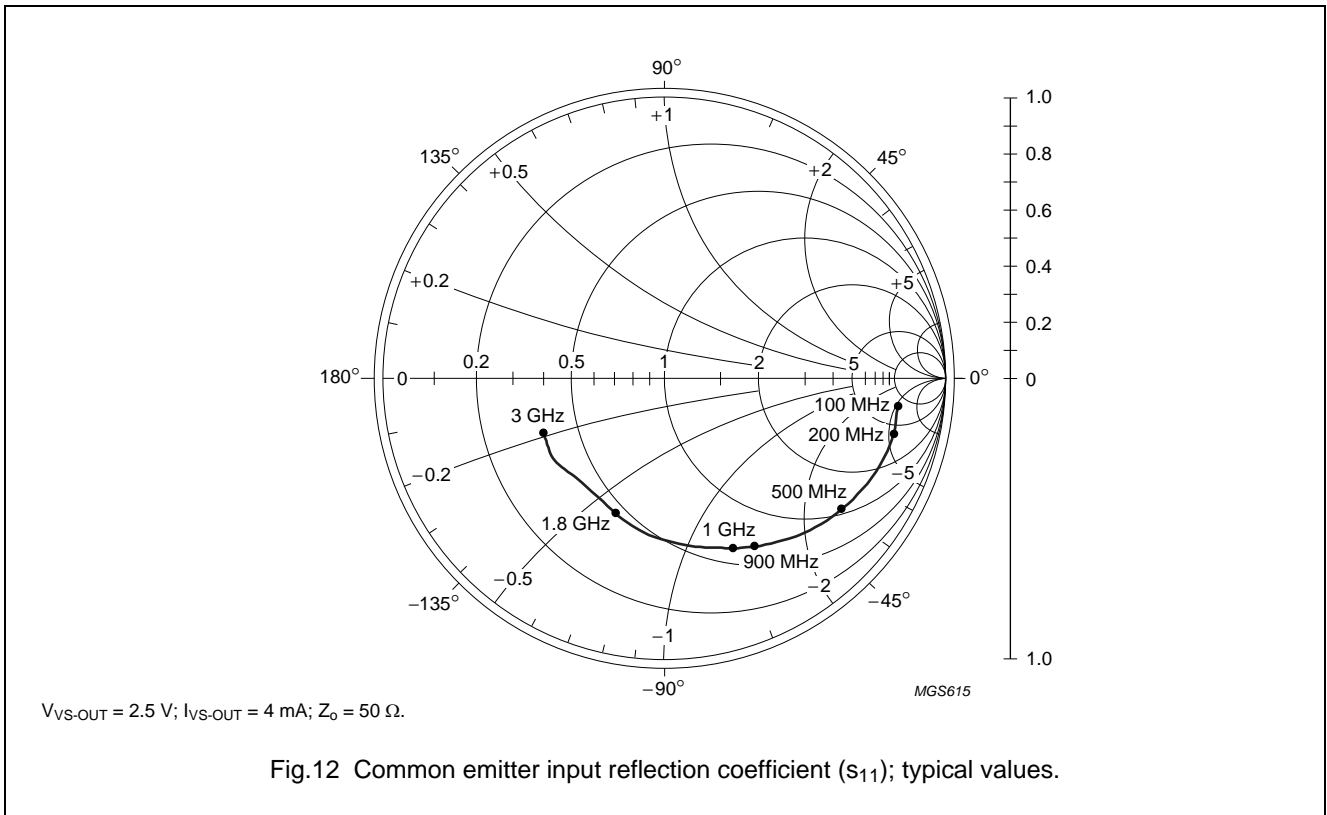


Fig.12 Common emitter input reflection coefficient ( $s_{11}$ ); typical values.

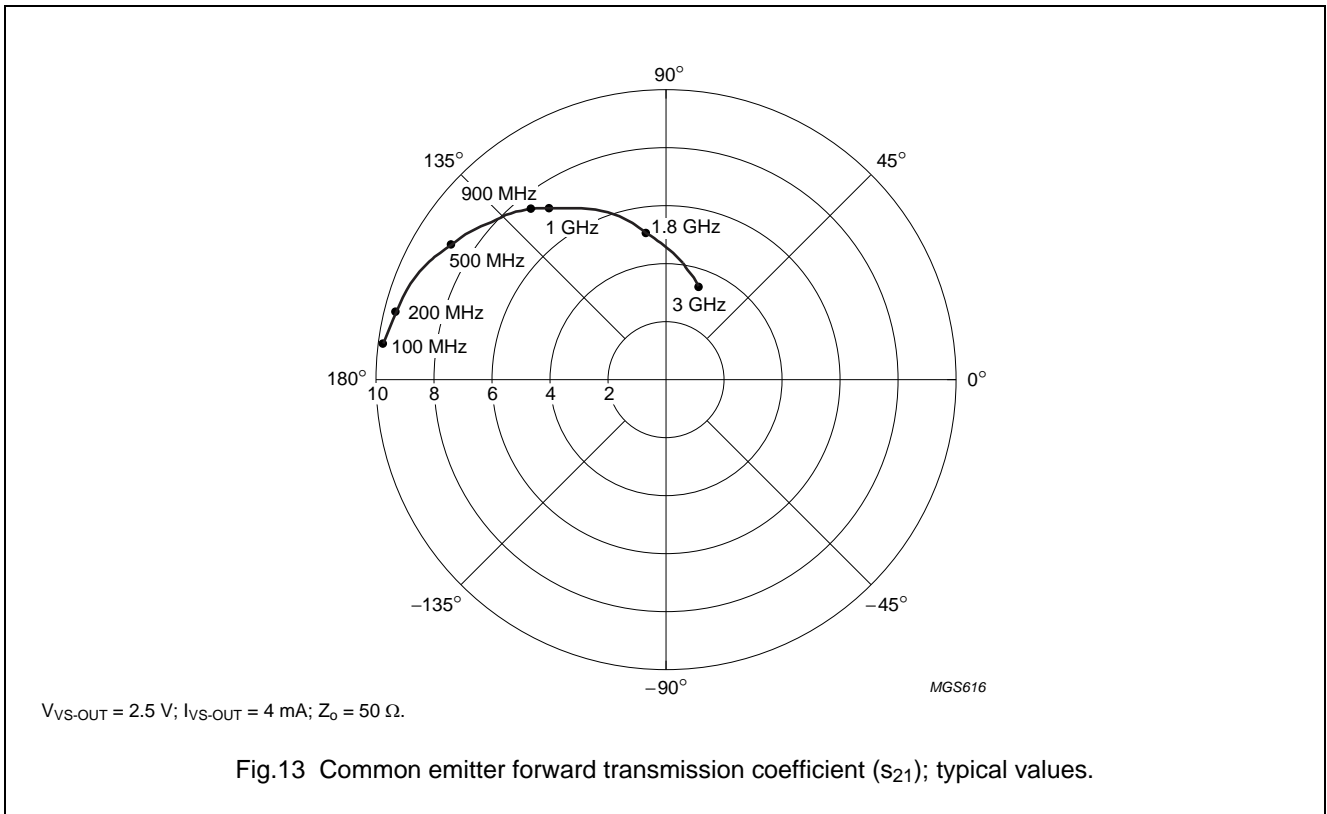
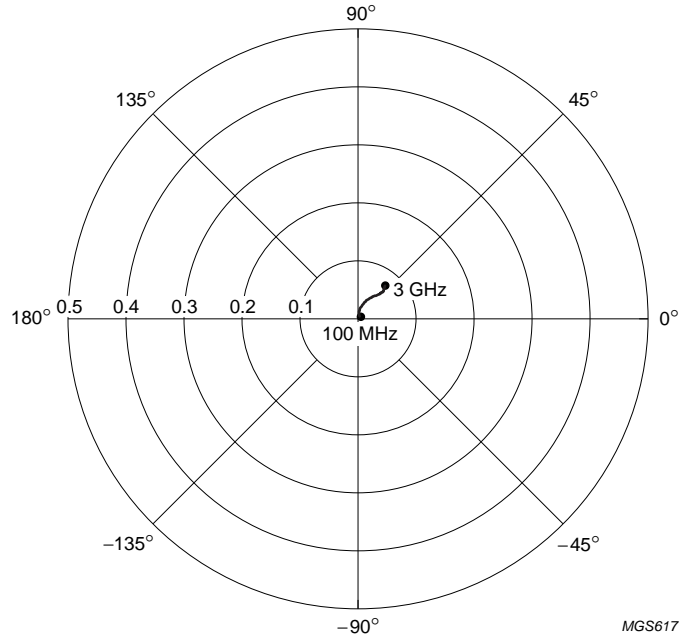


Fig.13 Common emitter forward transmission coefficient ( $s_{21}$ ); typical values.

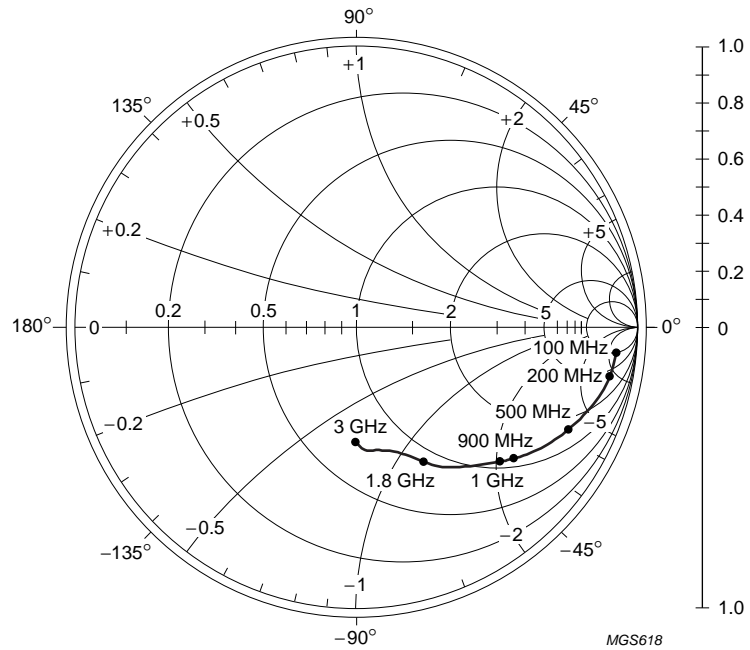
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$V_{VS-OUT} = 2.5\text{ V}$ ;  $I_{VS-OUT} = 4\text{ mA}$ ;  $Z_o = 50\ \Omega$ .

Fig.14 Common emitter reverse transmission coefficient ( $s_{12}$ ); typical values.



$V_{VS-OUT} = 2.5\text{ V}$ ;  $I_{VS-OUT} = 4\text{ mA}$ ;  $Z_o = 50\ \Omega$ .

Fig.15 Common emitter output reflection coefficient ( $s_{22}$ ); typical values.

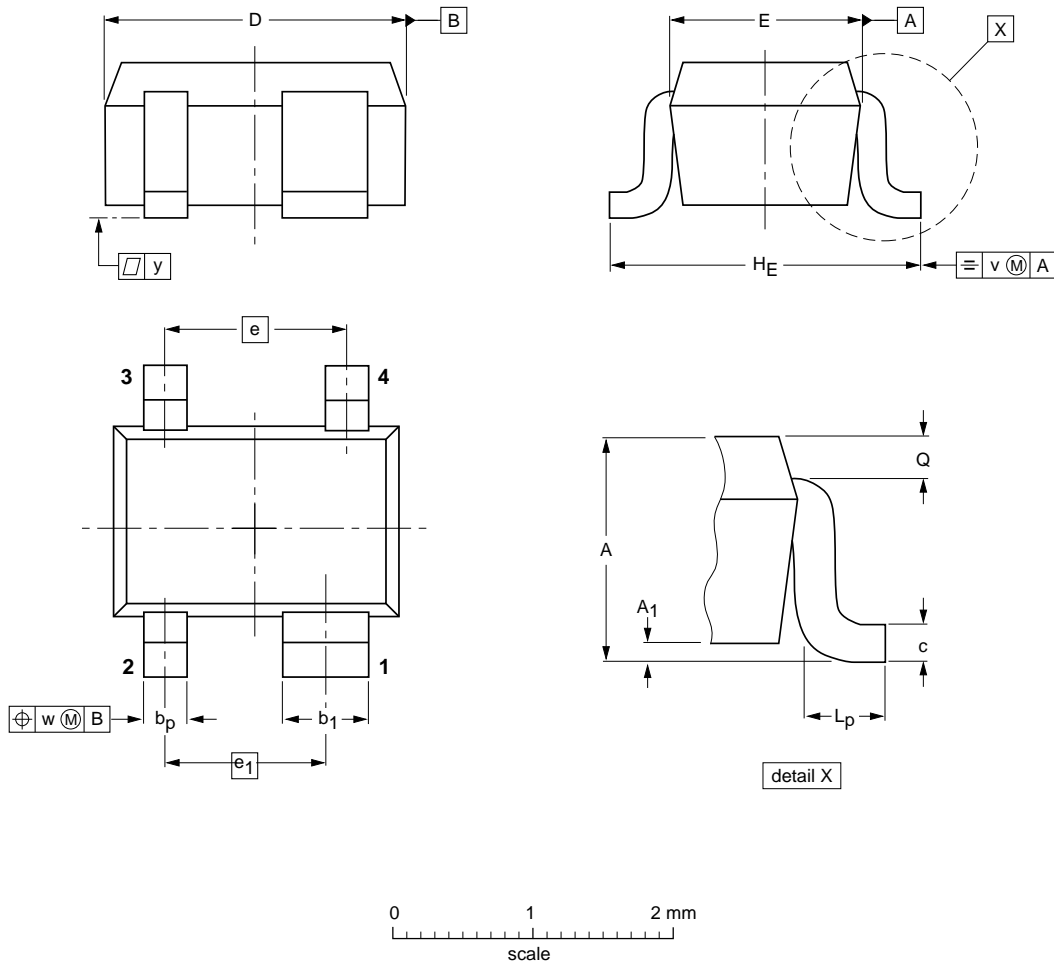
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PACKAGE OUTLINE

Plastic surface-mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max | b <sub>p</sub> | b <sub>1</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                   | 0.4<br>0.3     | 0.7<br>0.5     | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 1.15           | 2.2<br>2.0     | 0.45<br>0.15   | 0.23<br>0.13 | 0.2 | 0.2 | 0.1 |

| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-------|------|--|------------------------|----------------------|
|                    | IEC        | JEDEC | EIAJ |  |                        |                      |
| SOT343R            |            |       |      |  |                        | 97-05-21<br>06-03-16 |

## Silicon MMIC amplifier

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## DATA SHEET STATUS

| DOCUMENT STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)</sup> | DEFINITION  |
|--------------------------------|-------------------------------|---|
| Objective data sheet           | Development                   | This document contains data from the objective specification for product development. |
| Preliminary data sheet         | Qualification                 | This document contains data from the preliminary specification.                       |
| Product data sheet             | Production                    | This document contains the product specification.                                     |

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