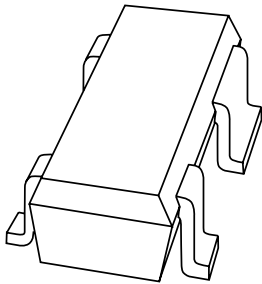


# DATA SHEET



## **BGA2003** Silicon MMIC amplifier

Product specification  
Supersedes data of 1999 Feb 25

1999 Jul 23

# Silicon MMIC amplifier

# BGA2003

## FEATURES

- Low current
- Very high power gain
- Low noise figure
- Integrated temperature compensated biasing
- Control pin for adjustment bias current
- Supply and RF output pin combined.

## APPLICATIONS

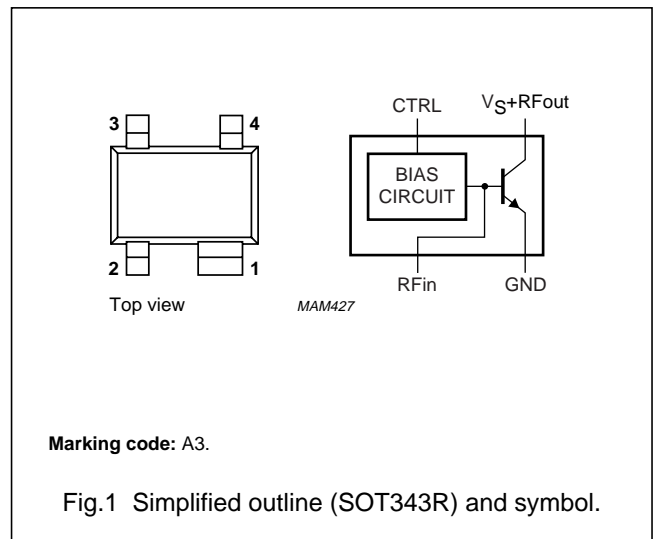
- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Low noise amplifiers
- Satellite television tuners (SATV)
- High frequency oscillators.

## DESCRIPTION

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

## PINNING

PIN	DESCRIPTION
1	GND
2	RF in
3	CTRL (bias current control)
4	V <sub>S</sub> + RF out



## 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; I <sub>CTRL</sub> = 1 mA; RF input AC coupled	11	–	mA
MSG	maximum stable gain	V <sub>V<sub>S</sub>-OUT</sub> = 2.5 V; f = 1800 MHz; T <sub>amb</sub> = 25 °C	16	–	dB
NF	noise figure	V <sub>V<sub>S</sub>-OUT</sub> = 2.5 V; f = 1800 MHz; Γ <sub>S</sub> = Γ <sub>opt</sub>	1.8	–	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
$V_{CTRL}$	voltage on control pin		–	2	V
$I_S$	supply current (DC)	forced by DC voltage on RF input or $I_{CTRL}$	–	30	mA
$I_{CTRL}$	control current		–	3	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	$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{CTRL} = 0.4\text{ mA}$	3	4.5	6	mA
		$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{CTRL} = 1.0\text{ mA}$	8	11	15	mA
MSG	maximum stable gain	$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 10\text{ mA}$ ; $f = 900\text{ MHz}$	–	24	–	dB
		$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 10\text{ mA}$ ; $f = 1800\text{ MHz}$	–	16	–	dB
$ S_{21} ^2$	insertion power gain	$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 10\text{ mA}$ ; $f = 900\text{ MHz}$	18	19	–	dB
		$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 10\text{ mA}$ ; $f = 1800\text{ MHz}$	13	14	–	dB
$S_{12}$	isolation	$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 0$ ; $f = 900\text{ MHz}$	–	26	–	dB
		$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 0$ ; $f = 1800\text{ MHz}$	–	20	–	dB
NF	noise figure	$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 10\text{ mA}$ ; $f = 900\text{ MHz}$ ; $\Gamma_S = \Gamma_{opt}$	–	1.8	2	dB
		$V_{VS-OUT} = 2.5\text{ V}$ ; $I_{VS-OUT} = 10\text{ mA}$ ; $f = 1800\text{ MHz}$ ; $\Gamma_S = \Gamma_{opt}$	–	1.8	2	dB
IP3(in)	input intercept point; note 1	$V_{VS-OUT} = 2.3\text{ V}$ ; $I_{VS-OUT} = 3.6\text{ mA}$ ; $f = 900\text{ MHz}$	–	–6.5	–	dBm
		$V_{VS-OUT} = 2.3\text{ V}$ ; $I_{VS-OUT} = 3.5\text{ mA}$ ; $f = 1800\text{ MHz}$	–	–4.8	–	dBm

## Note

1. See application note RNR-T45-99-B-0514.

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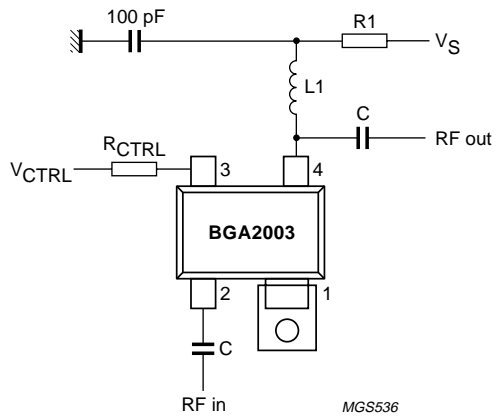


Fig.2 Typical application circuit.

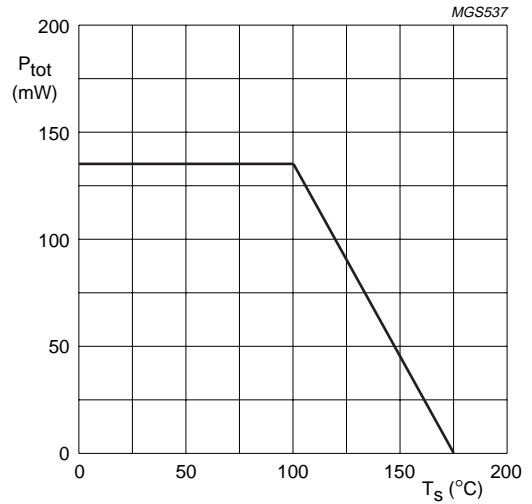
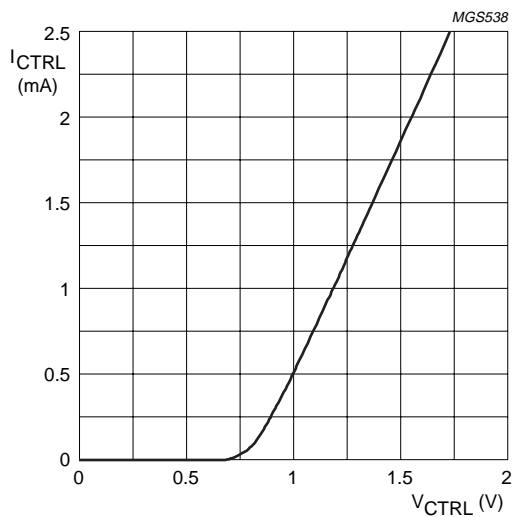
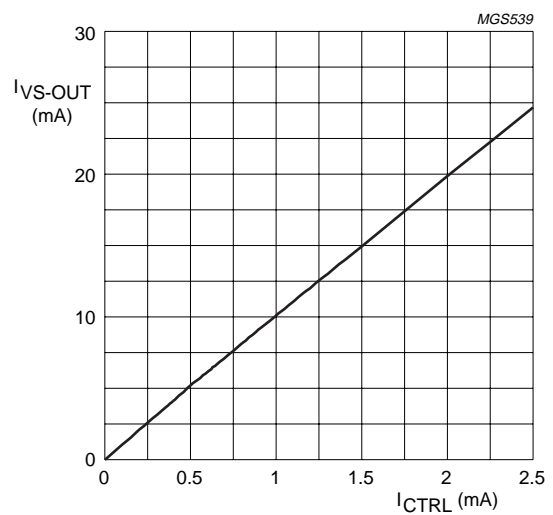


Fig.3 Power derating.



$$I_{CTRL} = (V_{CTRL} - 0.83) / 296$$

Fig.4 Control current as a function of the control voltage on pin 3; typical values.

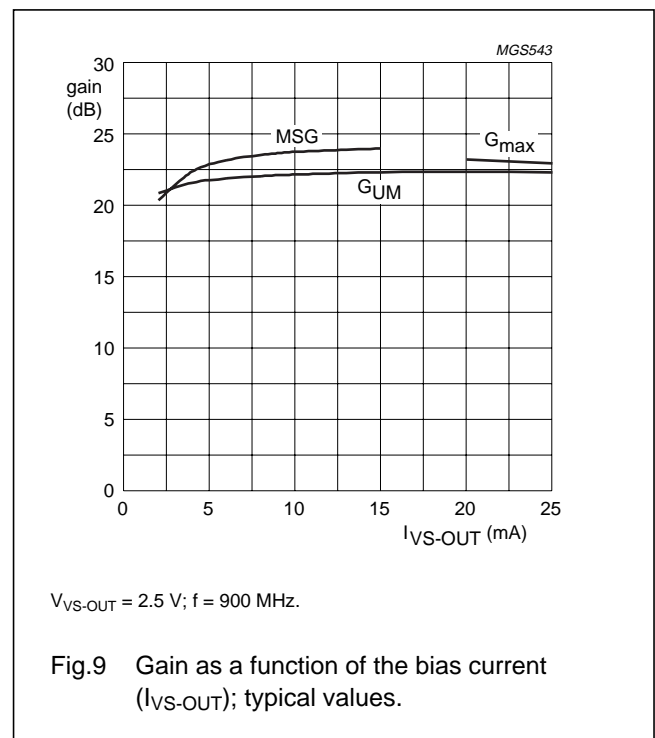
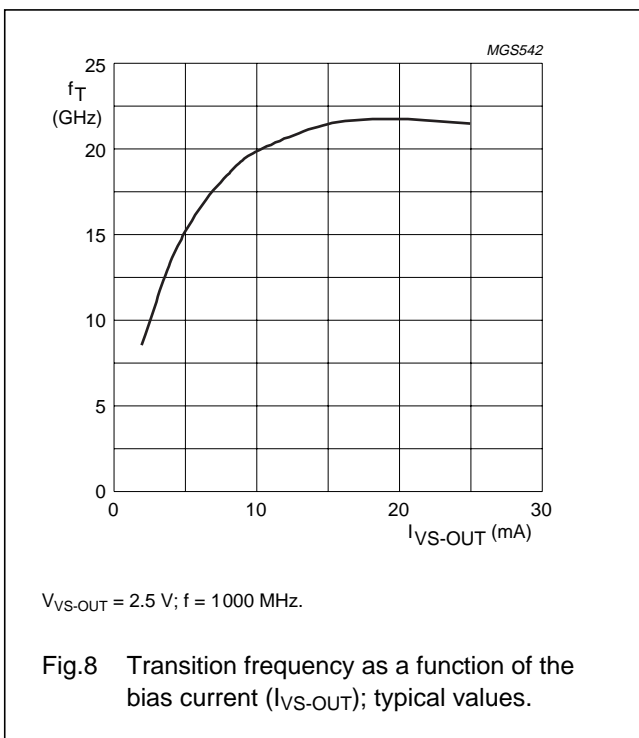
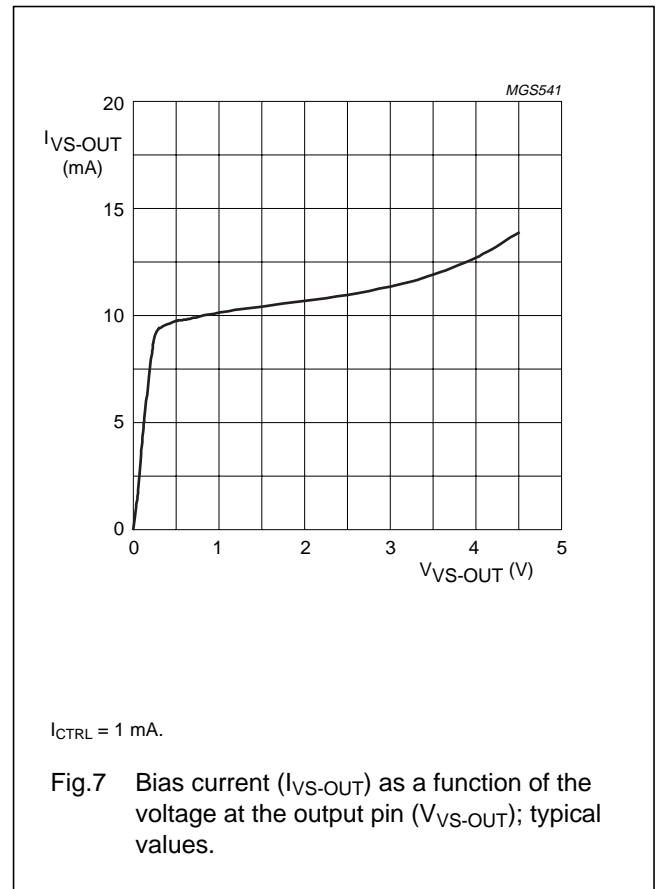
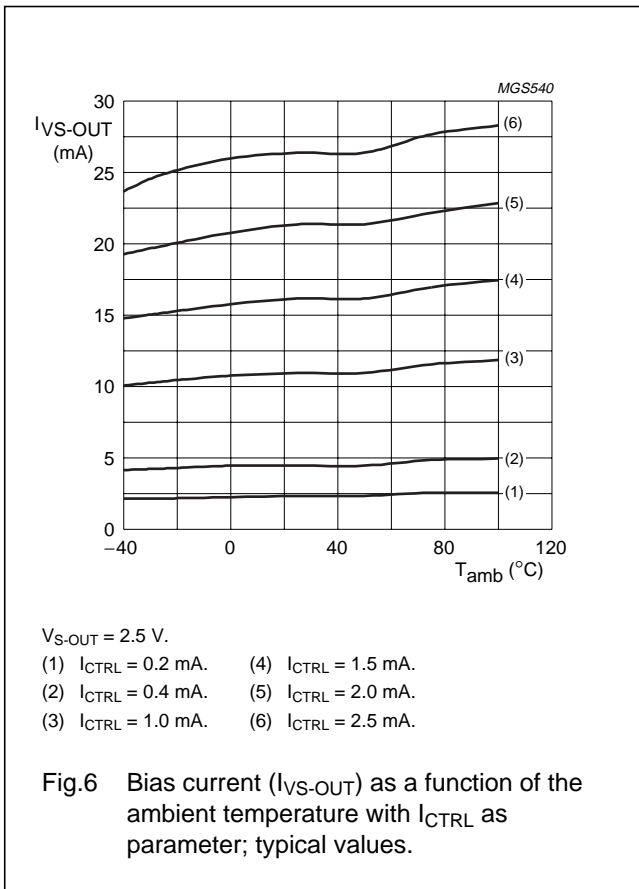


$$V_{S-OUT} = 2.5 \text{ V}$$

Fig.5 Bias current as a function of the control current; typical values.

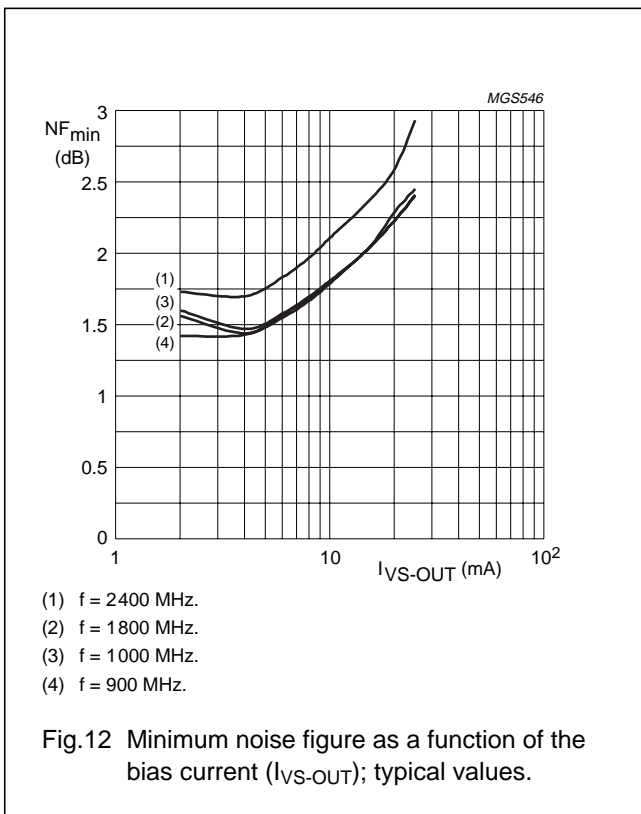
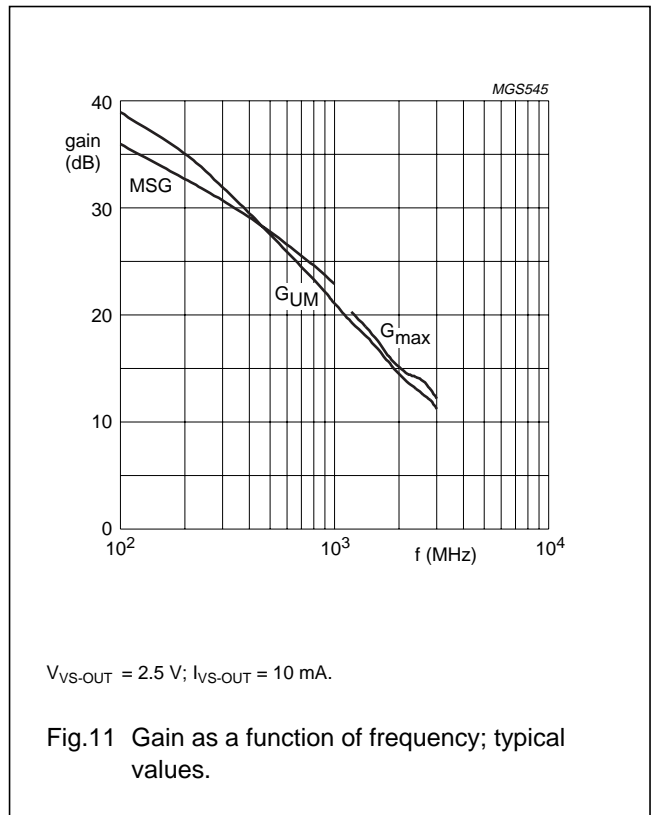
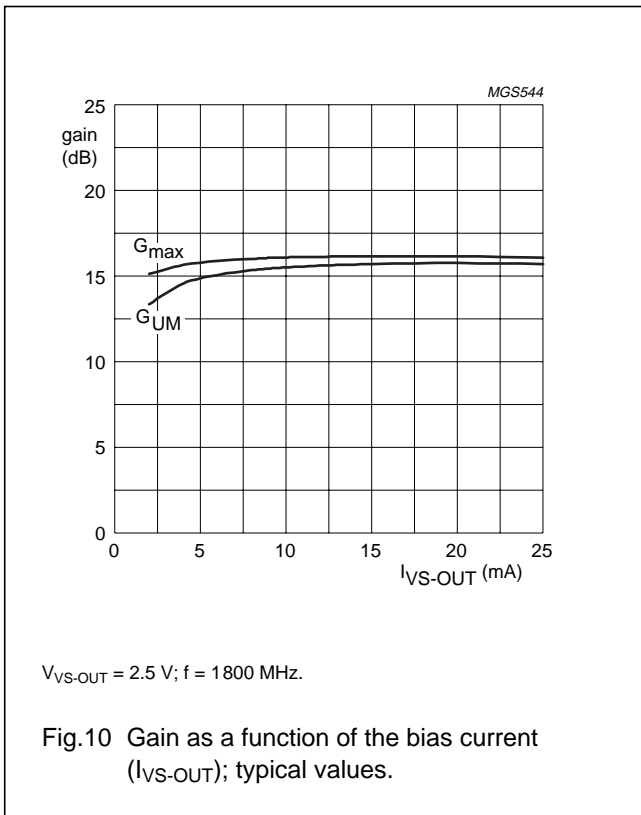
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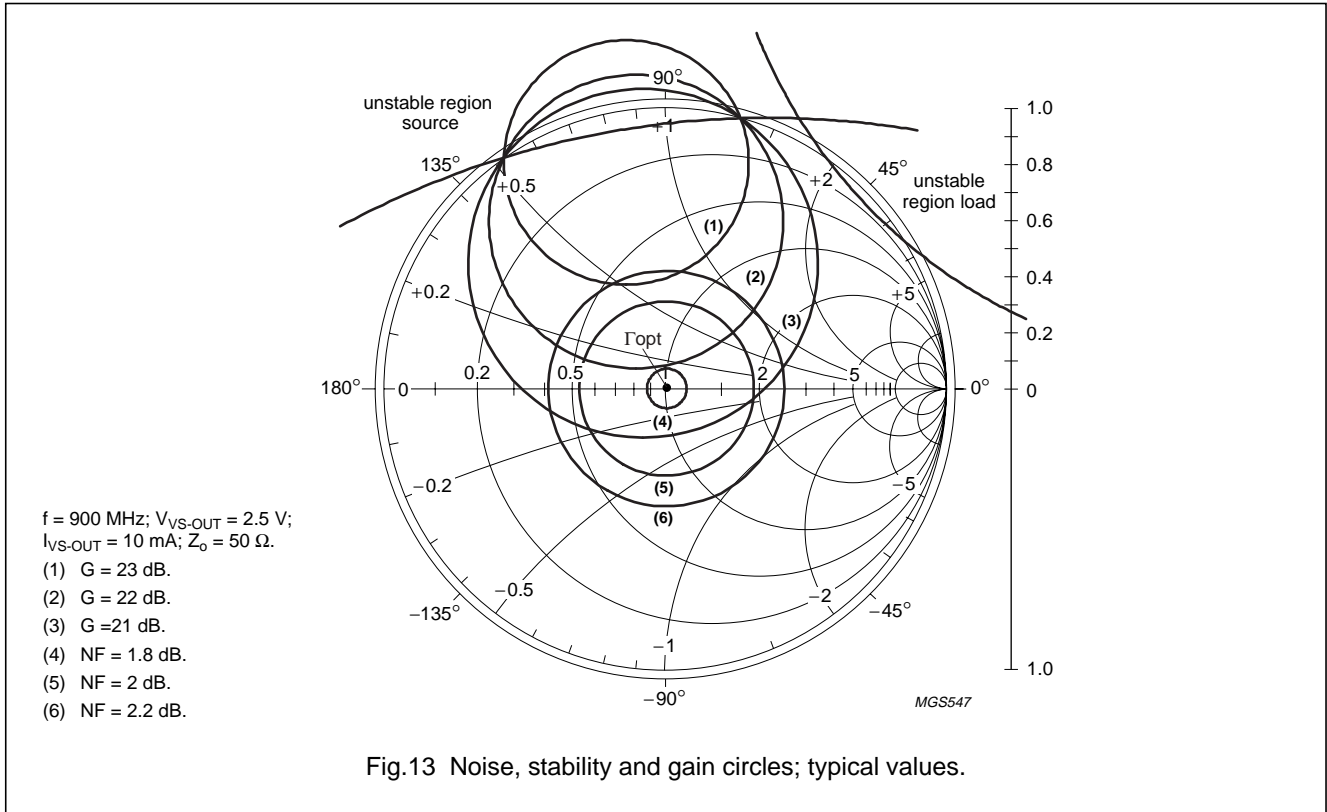


Fig.13 Noise, stability and gain circles; typical values.

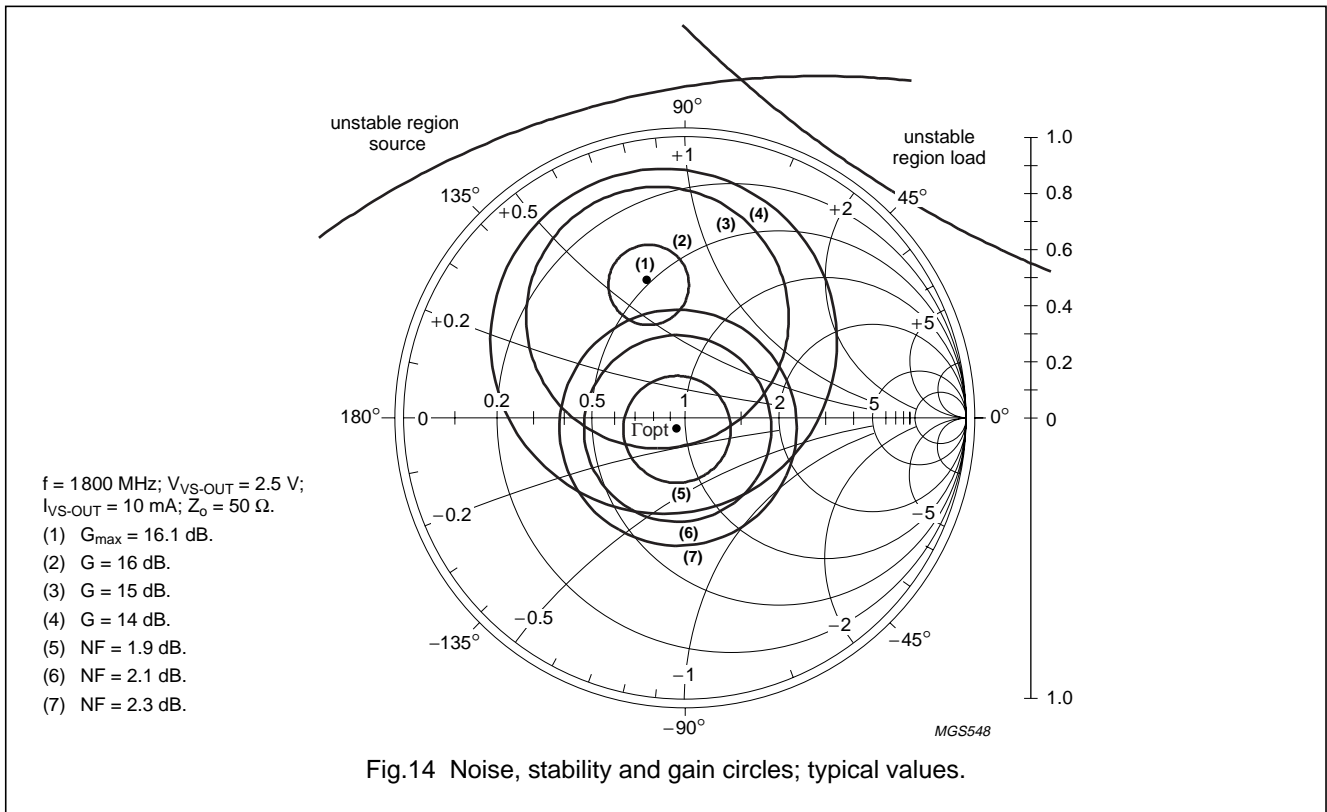
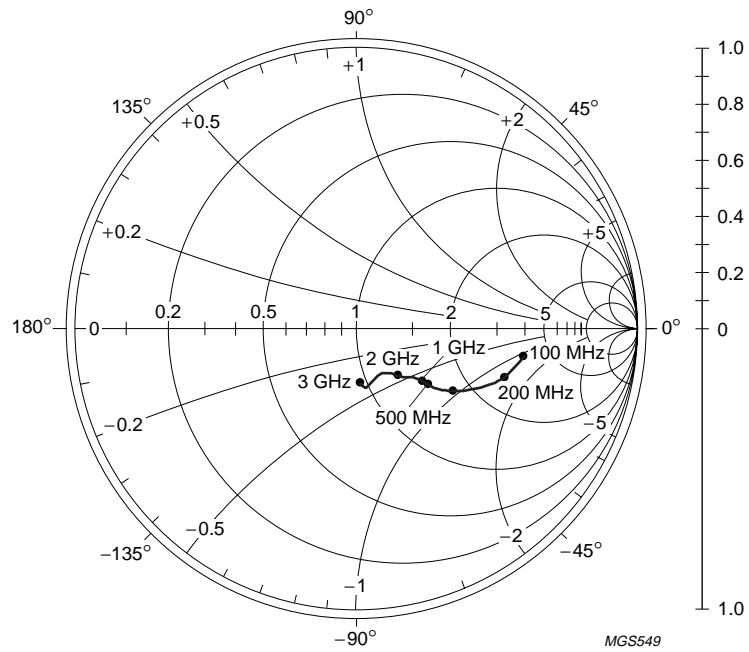


Fig.14 Noise, stability and gain circles; typical values.

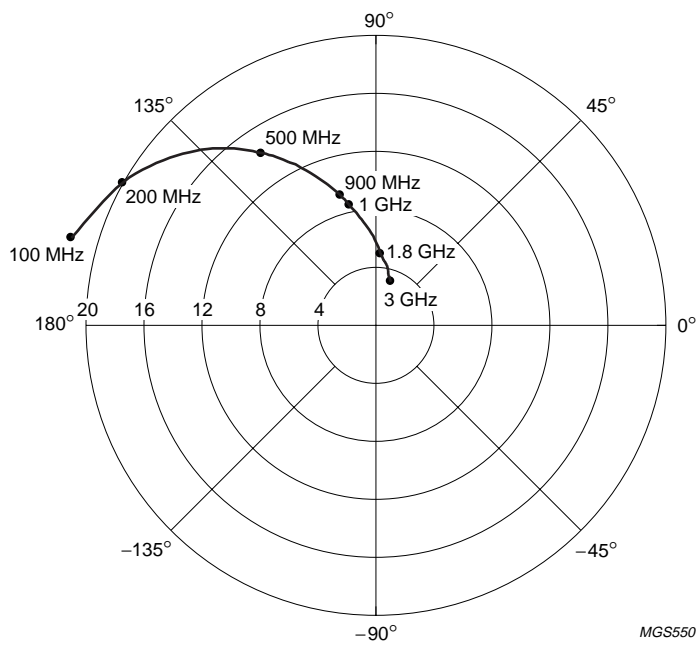
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$V_{VS-OUT} = 2.5\text{ V}$ ;  $I_{VS-OUT} = 10\text{ mA}$ ;  $Z_o = 50\ \Omega$ .

Fig.15 Common emitter input reflection coefficient ( $s_{11}$ ); typical values.



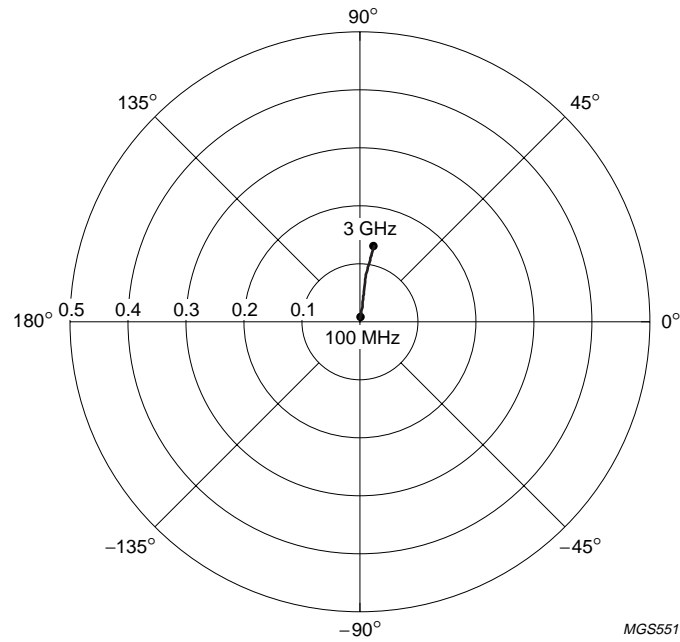
$V_{VS-OUT} = 2.5\text{ V}$ ;  $I_{VS-OUT} = 10\text{ mA}$ ;  $Z_o = 50\ \Omega$ .

Fig.16 Common emitter forward transmission coefficient ( $s_{21}$ ); typical values.



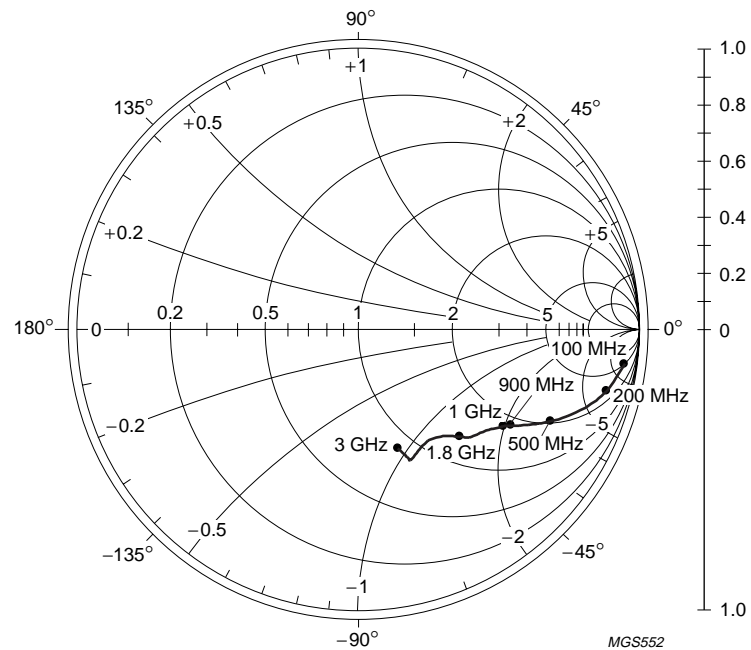
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$V_{VS-OUT} = 2.5\text{ V}$ ;  $I_{VS-OUT} = 10\text{ mA}$ ;  $Z_o = 50\ \Omega$ .

Fig.17 Common emitter reverse transmission coefficient ( $s_{12}$ ); typical values.



$V_{VS-OUT} = 2.5\text{ V}$ ;  $I_{VS-OUT} = 10\text{ mA}$ ;  $Z_o = 50\ \Omega$ .

Fig.18 Common emitter output reflection coefficient ( $s_{22}$ ); typical values.

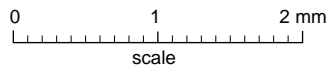
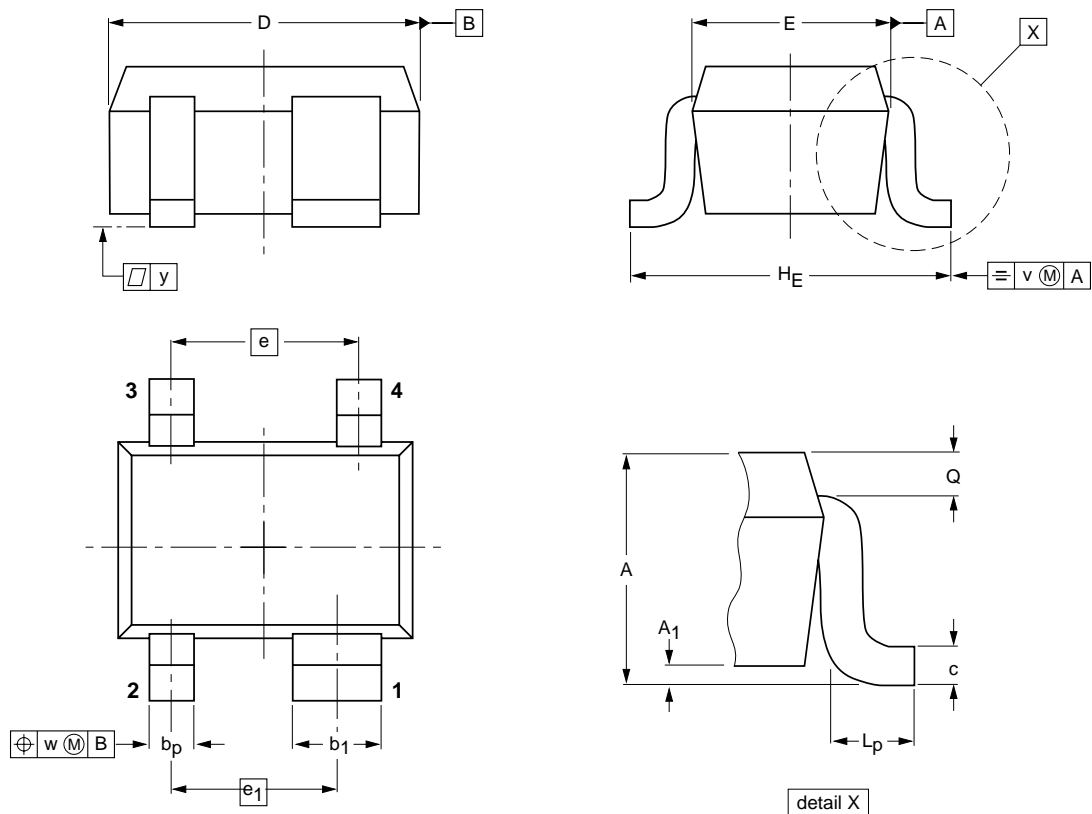
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PACKAGE OUTLINE

Plastic surface mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> 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 0.8	0.1	0.4 0.3	0.7 0.5	0.25 0.10	2.2 1.8	1.35 1.15	1.3	1.15	2.2 2.0	0.45 0.15	0.23 0.13	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT343R						97-05-21

## Silicon MMIC amplifier

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**DEFINITIONS**

<b>Data Sheet Status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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