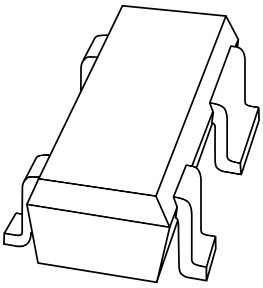
DATA SHEET



BGA2003
Silicon MMIC amplifier

Product specification
Supersedes data of 1999 Feb 25

1999 Jul 23

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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

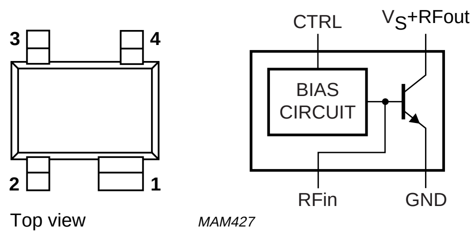
- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Low noise amplifiers
- Satellite television tuners (SATV)
- High frequency oscillators.

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_S + RF out



Marking code: A3.

Fig.1 Simplified outline (SOT343R) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_S	DC supply voltage	RF input AC coupled	–	4.5	V
I_S	DC supply current	$V_{VS\text{-}OUT}$ = 2.5 V; I_{CTRL} = 1 mA; RF input AC coupled	11	–	mA
MSG	maximum stable gain	$V_{VS\text{-}OUT}$ = 2.5 V; f = 1800 MHz; T_{amb} = 25 °C	16	–	dB
NF	noise figure	$V_{VS\text{-}OUT}$ = 2.5 V; f = 1800 MHz; $\Gamma_S = \Gamma_{opt}$	1.8	–	dB

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	$T_s \leq 100$ °C	–	135	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

THERMAL CHARACTERISTICS

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

CHARACTERISTICS

RF input AC coupled; $T_j = 25$ °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_S	supply current	$V_{VS\text{-}OUT} = 2.5$ V; $I_{CTRL} = 0.4$ mA	3	4.5	6	mA
		$V_{VS\text{-}OUT} = 2.5$ V; $I_{CTRL} = 1.0$ mA	8	11	15	mA
MSG	maximum stable gain	$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 10$ mA; f = 900 MHz	–	24	–	dB
		$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 10$ mA; f = 1800 MHz	–	16	–	dB
$\|s_{21}\|^2$	insertion power gain	$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 10$ mA; f = 900 MHz	18	19	–	dB
		$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 10$ mA; f = 1800 MHz	13	14	–	dB
s_{12}	isolation	$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 0$; f = 900 MHz	–	26	–	dB
		$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 0$; f = 1800 MHz	–	20	–	dB
NF	noise figure	$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 10$ mA; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$	–	1.8	2	dB
		$V_{VS\text{-}OUT} = 2.5$ V; $I_{VS\text{-}OUT} = 10$ mA; f = 1800 MHz; $\Gamma_S = \Gamma_{opt}$	–	1.8	2	dB
$IP3_{(in)}$	input intercept point; note 1	$V_{VS\text{-}OUT} = 2.3$ V; $I_{VS\text{-}OUT} = 3.6$ mA; f = 900 MHz	–	–6.5	–	dBm
		$V_{VS\text{-}OUT} = 2.3$ V; $I_{VS\text{-}OUT} = 3.5$ mA; f = 1800 MHz	–	–4.8	–	dBm

Note

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

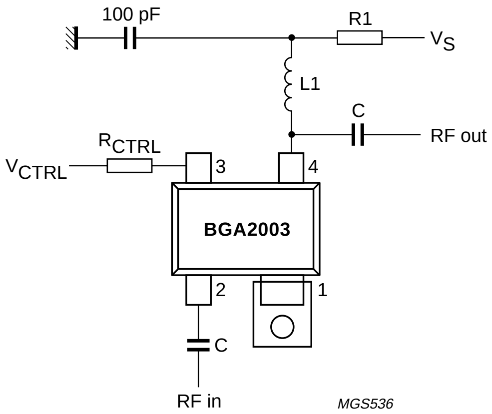


Fig.2 Typical application circuit.

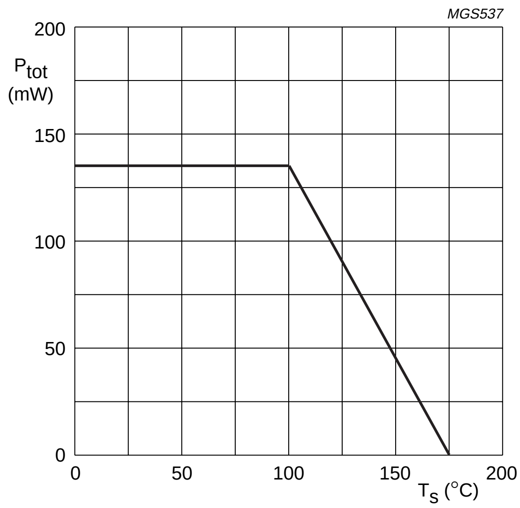
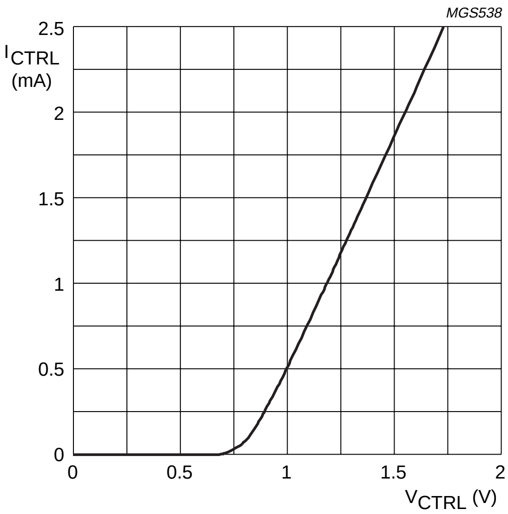
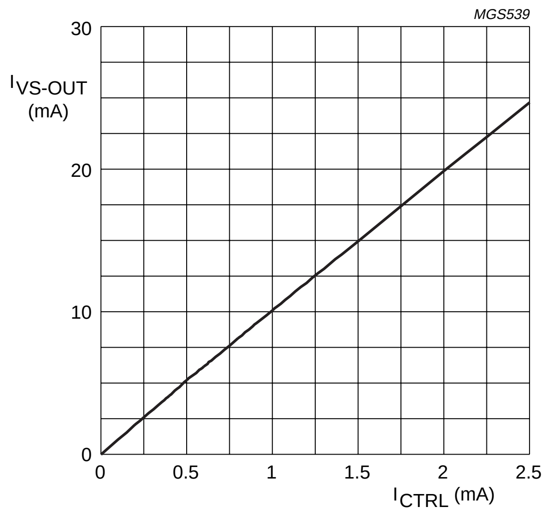


Fig.3 Power derating.



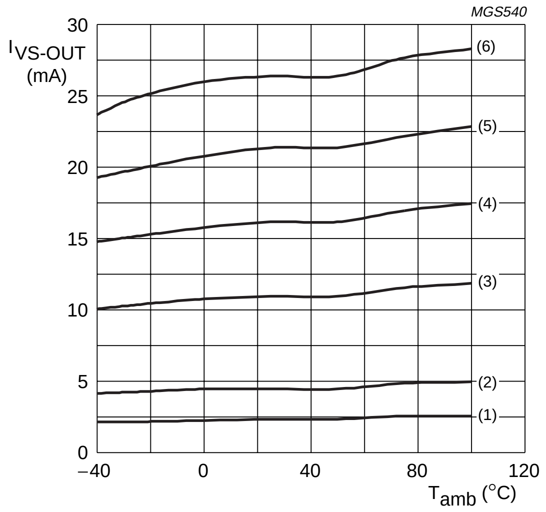
$I_{CTRL} = (V_{CTRL} - 0.83)/296$.

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



$V_{S-OUT} = 2.5$ V.

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



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

(1) I_{CTRL} = 0.2 mA.

(2) I_{CTRL} = 0.4 mA.

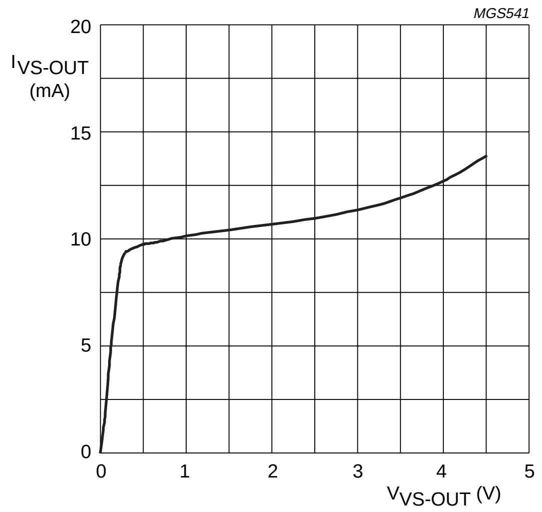
(3) I_{CTRL} = 1.0 mA.

(4) I_{CTRL} = 1.5 mA.

(5) I_{CTRL} = 2.0 mA.

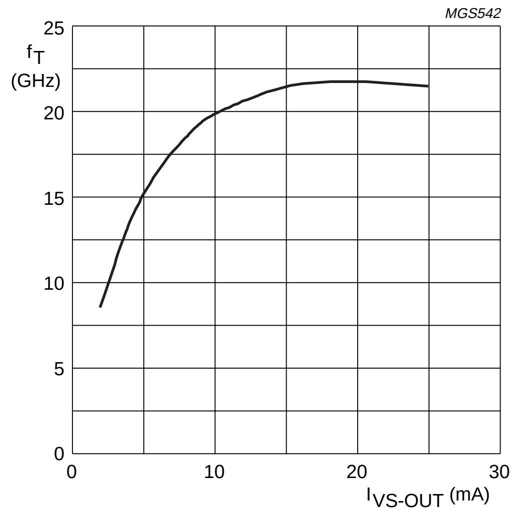
(6) I_{CTRL} = 2.5 mA.

Fig.6 Bias current ($I_{VS\text{-}OUT}$) as a function of the ambient temperature with I_{CTRL} as parameter; typical values.



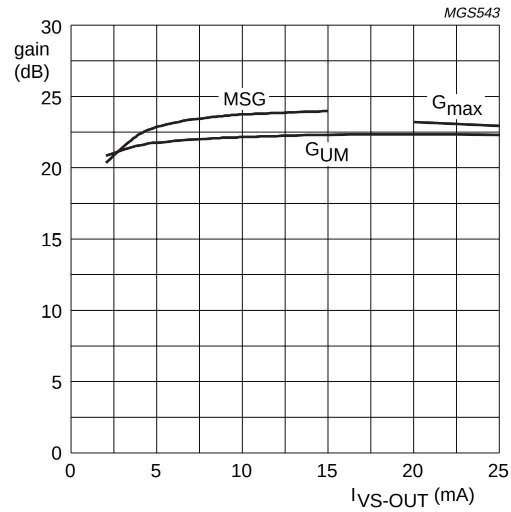
I_{CTRL} = 1 mA.

Fig.7 Bias current ($I_{VS\text{-}OUT}$) as a function of the voltage at the output pin ($V_{VS\text{-}OUT}$); typical values.



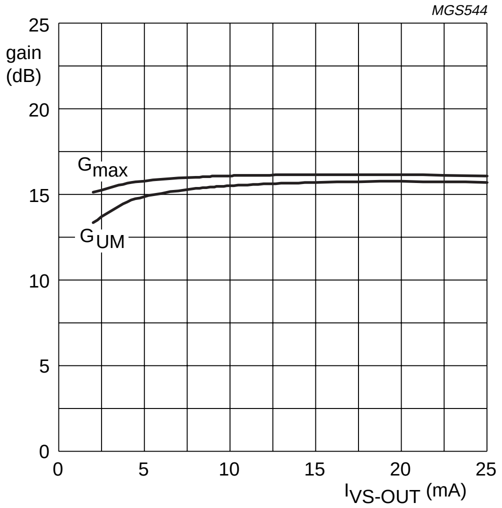
$V_{VS\text{-}OUT}$ = 2.5 V; f = 1000 MHz.

Fig.8 Transition frequency as a function of the bias current ($I_{VS\text{-}OUT}$); typical values.



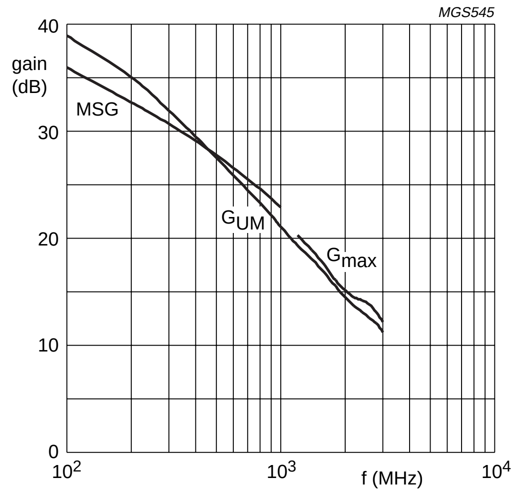
$V_{VS\text{-}OUT}$ = 2.5 V; f = 900 MHz.

Fig.9 Gain as a function of the bias current ($I_{VS\text{-}OUT}$); typical values.



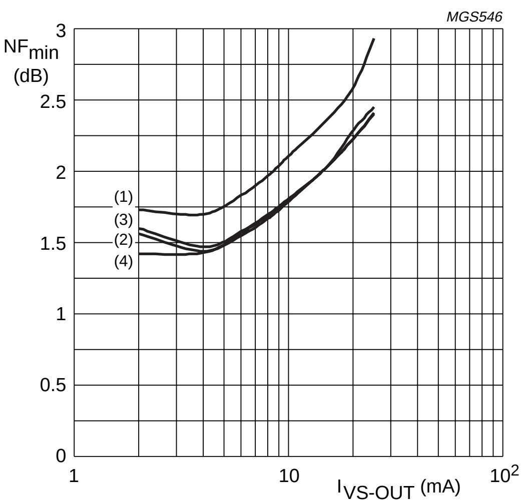
$V_{VS\text{-}OUT}$ = 2.5 V; f = 1800 MHz.

Fig.10 Gain as a function of the bias current ($I_{VS\text{-}OUT}$); typical values.



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

Fig.11 Gain as a function of frequency; typical values.



(1) f = 2400 MHz.
(2) f = 1800 MHz.
(3) f = 1000 MHz.
(4) f = 900 MHz.

Fig.12 Minimum noise figure as a function of the bias current ($I_{VS\text{-}OUT}$); typical values.

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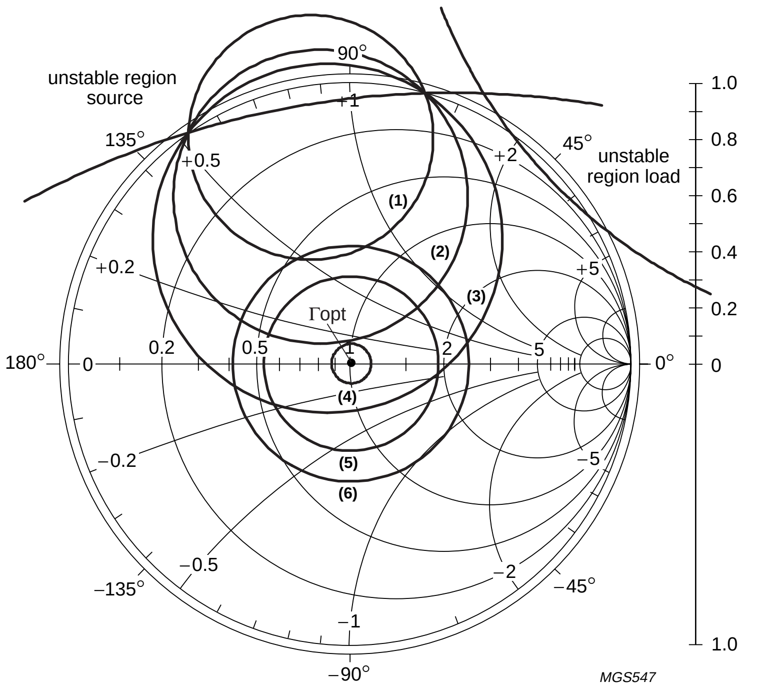


f = 900 MHz; $V_{VS\text{-}OUT}$ = 2.5 V;
$I_{VS\text{-}OUT}$ = 10 mA; Z_o = 50 Ω.

(1) G = 23 dB.

(2) G = 22 dB.

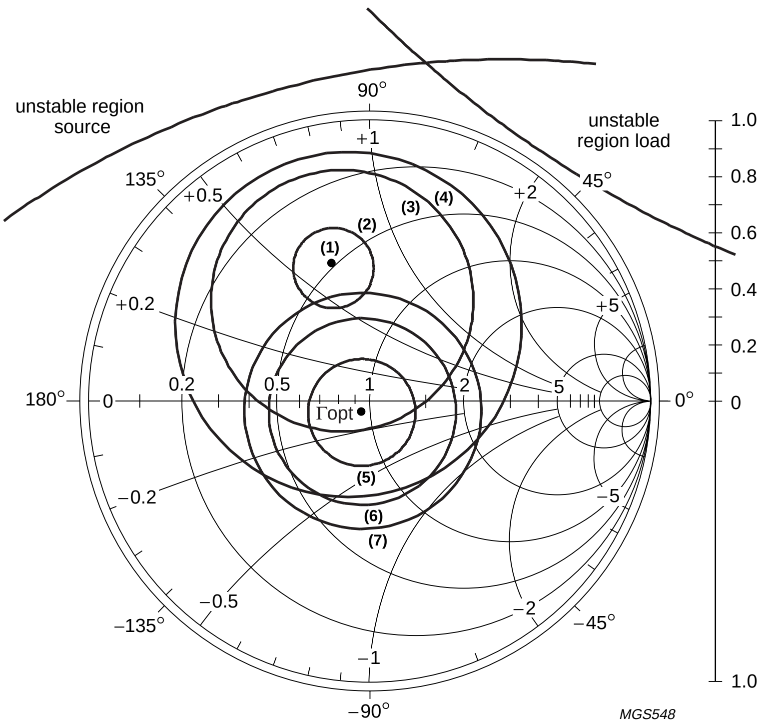
(3) G =21 dB.

(4) NF = 1.8 dB.

(5) NF = 2 dB.

(6) NF = 2.2 dB.

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



f = 1800 MHz; $V_{VS\text{-}OUT}$ = 2.5 V;
$I_{VS\text{-}OUT}$ = 10 mA; Z_o = 50 Ω.

(1) G_{max} = 16.1 dB.

(2) G = 16 dB.

(3) G = 15 dB.

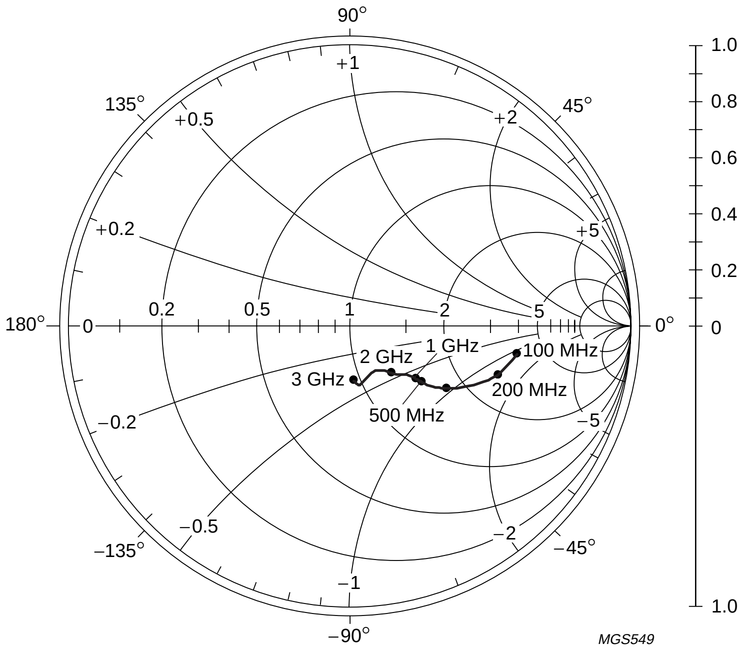
(4) G = 14 dB.

(5) NF = 1.9 dB.

(6) NF = 2.1 dB.

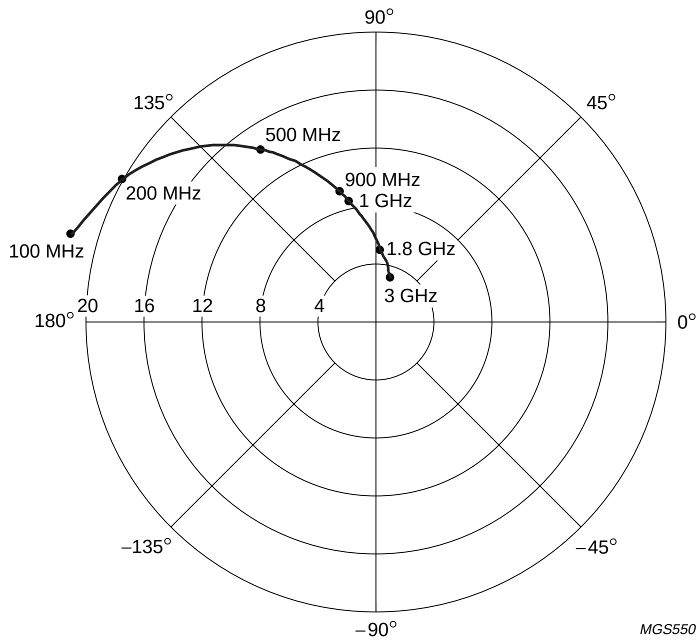
(7) NF = 2.3 dB.

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



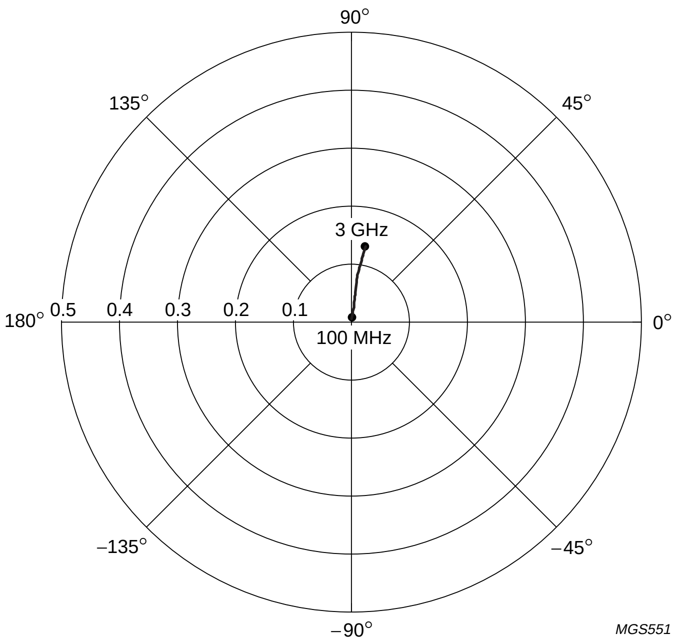
$V_{VS\text{-}OUT}$ = 2.5 V; $I_{VS\text{-}OUT}$ = 10 mA; Z_o = 50 Ω.

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



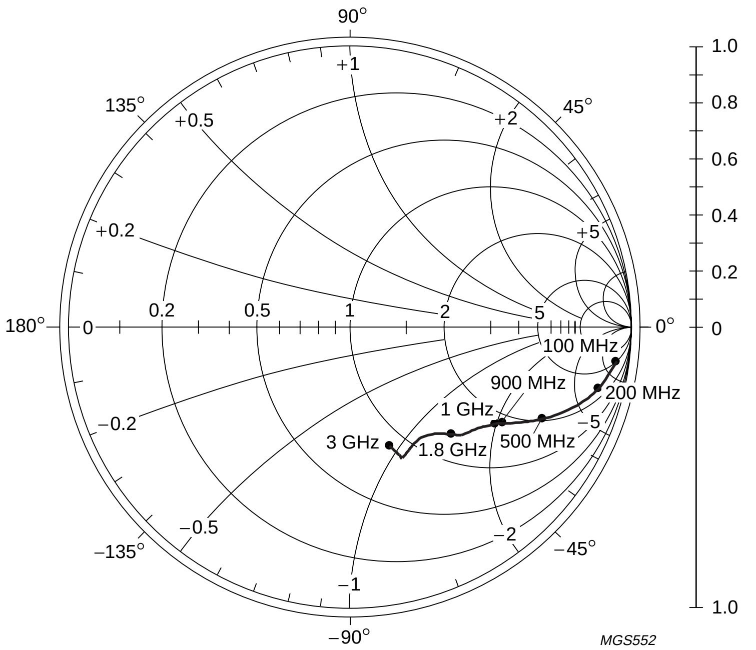
$V_{VS\text{-}OUT}$ = 2.5 V; $I_{VS\text{-}OUT}$ = 10 mA; Z_o = 50 Ω.

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



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

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

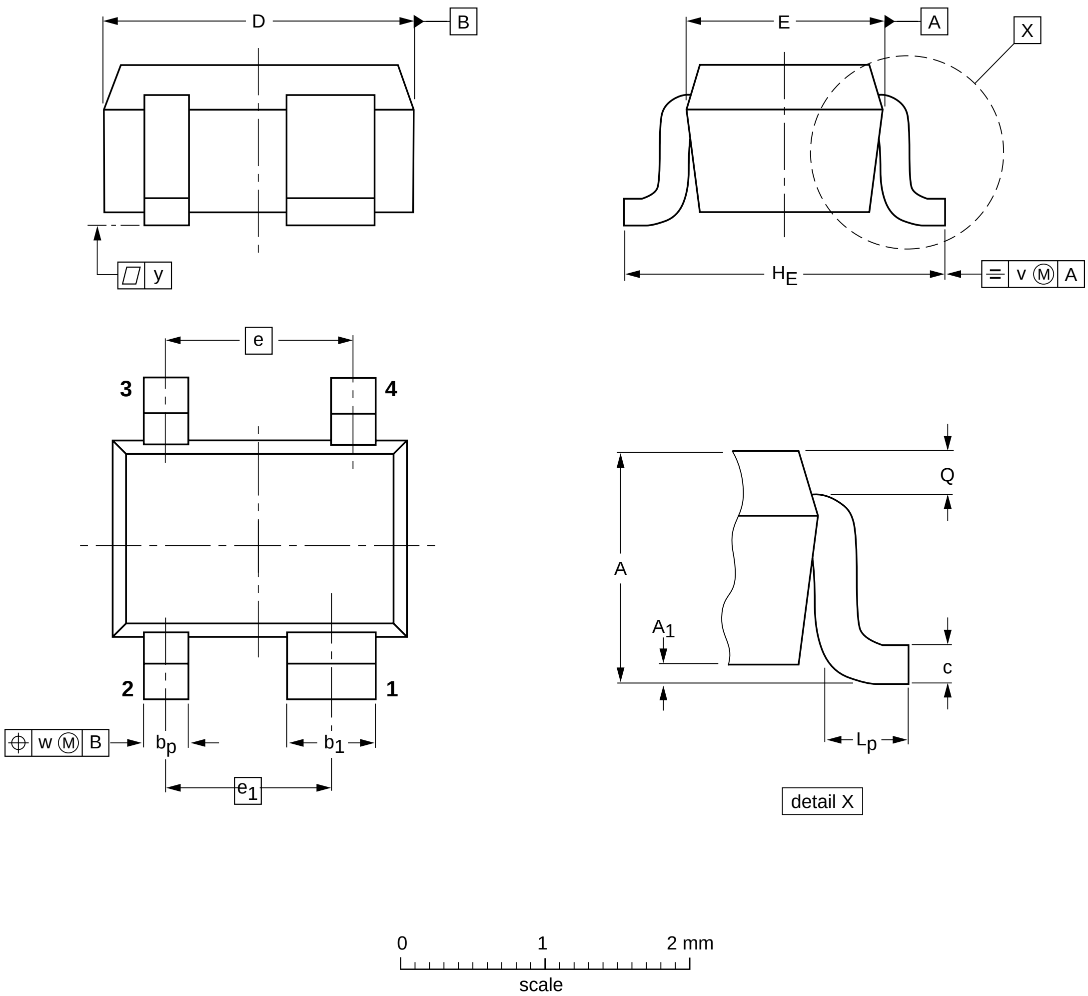


$V_{VS\text{-}OUT}$ = 2.5 V; $I_{VS\text{-}OUT}$ = 10 mA; Z_o = 50 Ω.

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

PACKAGE OUTLINE

Plastic surface mounted package; reverse pinning; 4 leads **SOT343R**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	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

DEFINITIONS

Data Sheet Status	
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.
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.	

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