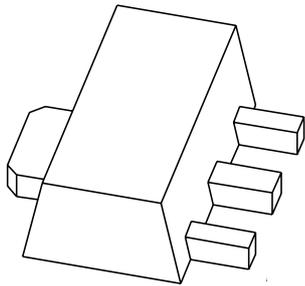


# DATA SHEET



## **BGA6589**

MMIC wideband medium power  
amplifier

Product specification

2003 Sep 19

# MMIC wideband medium power amplifier

# BGA6589

### FEATURES

- Broadband 50 Ω gain block
- 20 dBm output power
- SOT89 package
- Single supply voltage needed.

### APPLICATIONS

- Broadband medium power gain blocks
- Small signal high linearity amplifiers
- Variable gain and high output power in combination with the BGA2031
- Cellular, PCS and CDPD
- IF/RF buffer amplifier
- Wireless data SONET
- Oscillator amplifier, final PA
- Drivers for CATV amplifier.

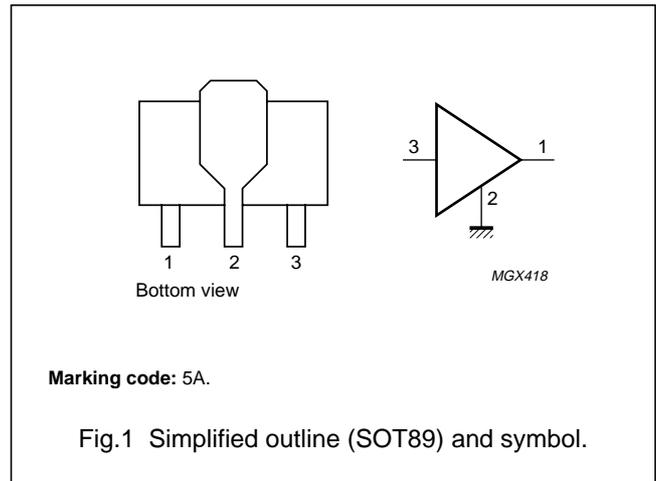
### DESCRIPTION

Silicon Monolithic Microwave Integrated Circuit (MMIC) wideband medium power amplifier with internal matching circuit in a 4-pin SOT89 plastic low thermal resistance SMD package.

The BGA6x89 series of medium power gain blocks are resistive feedback Darlington configured amplifiers. Resistive feedback provides large bandwidth with high accuracy.

### PINNING

PIN	DESCRIPTION
1	RF out/bias
2	GND
3	RF in



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
$V_S$	DC supply voltage	$I_S = 84 \text{ mA}$	4.8	V
$I_S$	DC supply current	$V_S = 9 \text{ V}; R_{\text{bias}} = 51 \text{ } \Omega; T_j = 25 \text{ } ^\circ\text{C}$	81	mA
$ s_{21} ^2$	insertion power gain	$f = 1.95 \text{ GHz}$	17	dB
NF	noise figure	$f = 1.95 \text{ GHz}$	3.3	dB
$P_{L \text{ 1 dB}}$	load power at 1 dB compression	$f = 850 \text{ MHz}$	21	dBm
		$f = 1.95 \text{ GHz}$	20	dBm

### 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.

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**LIMITING VALUES**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_S$	DC device voltage	RF input AC coupled	–	6	V
$I_S$	DC supply current		–	150	mA
$P_{tot}$	total power dissipation	$T_s \leq 70\text{ °C}$ ; note 1	–	800	mW
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	operating junction temperature		–	150	°C
$P_D$	maximum drive power		–	15	dBm

**Note**

- $T_s$  is the temperature at the soldering point of pin 2.

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to solder point	$T_s \leq 70\text{ °C}$ note 1	100	K/W

**Note**

- $T_s$  is the temperature at the soldering point of pin 2.

**STATIC CHARACTERISTICS** $T_j = 25\text{ °C}$ ;  $V_S = 9\text{ V}$ ;  $R_{bias} = 51\ \Omega$ ; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_S$	supply current		73	81	89	mA

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**CHARACTERISTICS**

$V_S = 9\text{ V}$ ;  $I_S = 84\text{ mA}$ ;  $T_{\text{amb}} = 25\text{ °C}$ ;  $IP3_{(\text{out})}$  tone spacing = 1 MHz;  $P_L = 0\text{ dBm}$  per tone (see Fig.2);  $R_{\text{bias}} = 51\ \Omega$ ;  $Z_L = Z_S = 50\ \Omega$ ; unless otherwise specified.

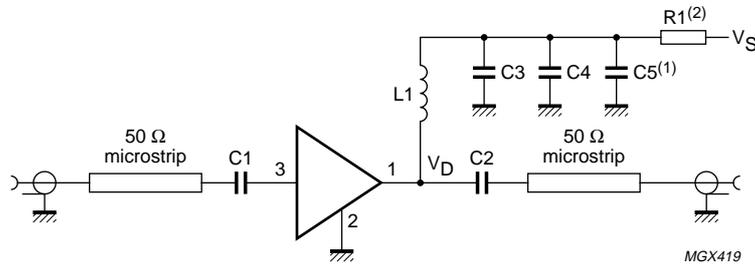
SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
$ s_{21} ^2$	insertion power gain	f = 850 MHz	22	dB
		f = 1.95 GHz	17	dB
		f = 2.5 GHz	15	dB
$R_{L\text{ IN}}$	return losses input	f = 850 MHz	9	dB
		f = 1.95 GHz	11	dB
		f = 2.5 GHz	15	dB
$R_{L\text{ OUT}}$	return losses output	f = 850 MHz	10	dB
		f = 1.95 GHz	13	dB
		f = 2.5 GHz	13	dB
NF	noise figure	f = 850 MHz	3.0	dB
		f = 1.95 GHz	3.3	dB
		f = 2.5 GHz	3.4	dB
K	stability factor	f = 850 MHz	1.1	–
		f = 2.5 GHz	1.1	–
$P_{L\ 1\text{ dB}}$	load power	at 1 dB gain compression; f = 850 MHz	21	dBm
		at 1 dB gain compression; f = 1.95 GHz	20	dBm
$IP3_{(\text{in})}$	input intercept point	f = 850 MHz	11	dBm
		f = 2.5 GHz	15	dBm
$IP3_{(\text{out})}$	output intercept point	f = 850 MHz	33	dBm
		f = 2.5 GHz	30	dBm

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APPLICATION INFORMATION

Figure 2 shows a typical application circuit for the BGA6589 MMIC. The device is internally matched to 50 Ω, and therefore does not require any external matching. The value of the input and output DC blocking capacitors C1 and C2 depends on the operating frequency; see the tables below. Capacitors C1 and C2 are used in conjunction with L1 and C3 to fine tune the input and output impedance. For optimum supply decoupling, a 1 μF capacitor (C5) can be added. The external components should be placed as close as possible to the MMIC. When using via holes, use multiple via holes per pin in order to limit ground path induction. Resistor R1 is a bias resistor providing DC current stability with temperature.



- (1) Optional capacitor for optimum supply decoupling.
- (2) R1 values at operating supply voltage:  
 VS = 6 V; R1 = 15 Ω.  
 VS = 9 V; R1 = 51 Ω.  
 VS = 11.5 V; R1 = 82 Ω.

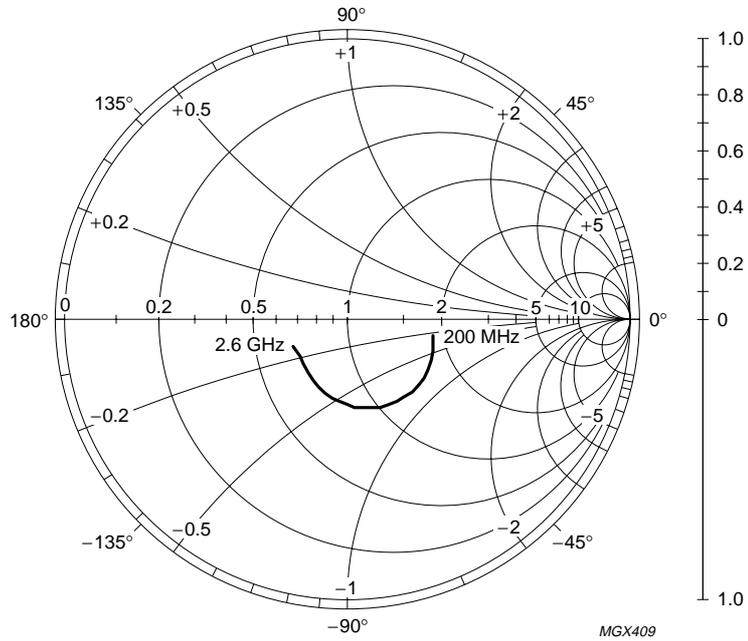
Fig.2 Typical application circuit.

Table 1 Component descriptions (see Fig.2)

COMPONENT	DESCRIPTION	DIMENSIONS	VALUE AT OPERATING FREQUENCY				
			500 MHz	800 MHz	1950 MHz	2400 MHz	3500 MHz
C1, C2	multilayer ceramic chip capacitor	0603	220 pF	100 pF	68 pF	56 pF	39 pF
C3	multilayer ceramic chip capacitor	0603	1 nF	1 nF	1 nF	1 nF	1 nF
C4	multilayer ceramic chip capacitor	0603	100 pF	68 pF	22 pF	22 pF	15 pF
C5 (optional)	electrolytic or tantalum capacitor	0603	1 μF	1 μF	1 μF	1 μF	1 μF
L1	SMD inductor	0603	68 nH	33 nH	22 nH	18 nH	15 nH
R1	SMD resistor 0.5 W; VS = 9 V	—	—	—	—	—	—

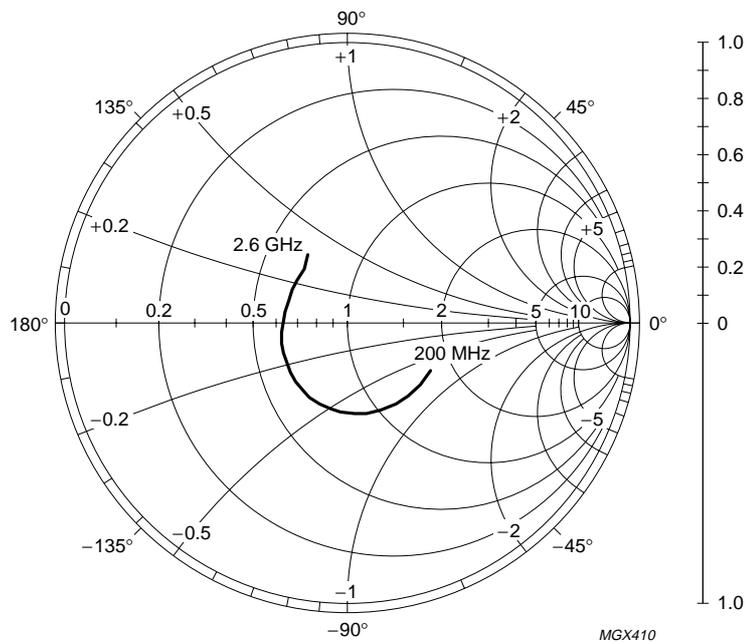
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$I_S = 84 \text{ mA}$ ;  $V_S = 9 \text{ V}$ ;  $P_D = -30 \text{ dBm}$ ;  $Z_O = 50 \Omega$ .

Fig.3 Input reflection coefficient ( $s_{11}$ ); typical values.

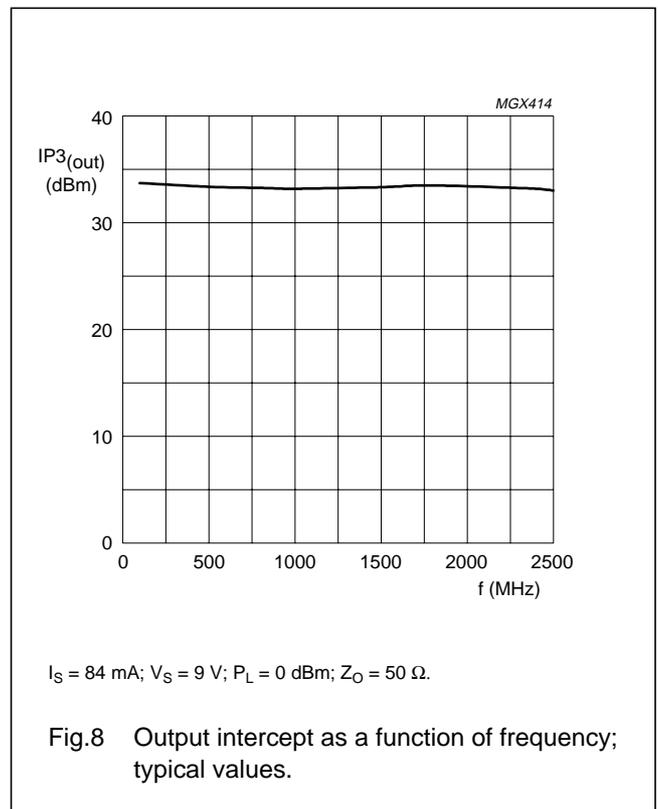
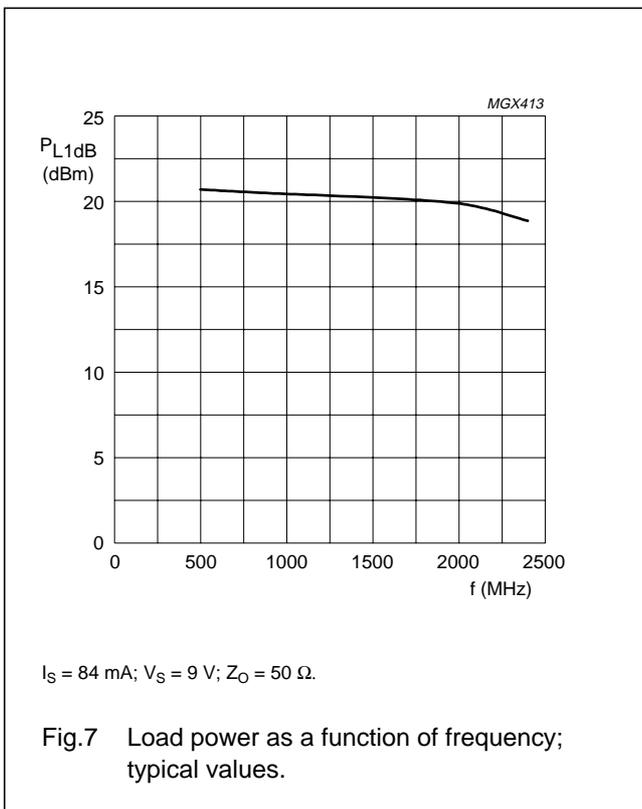
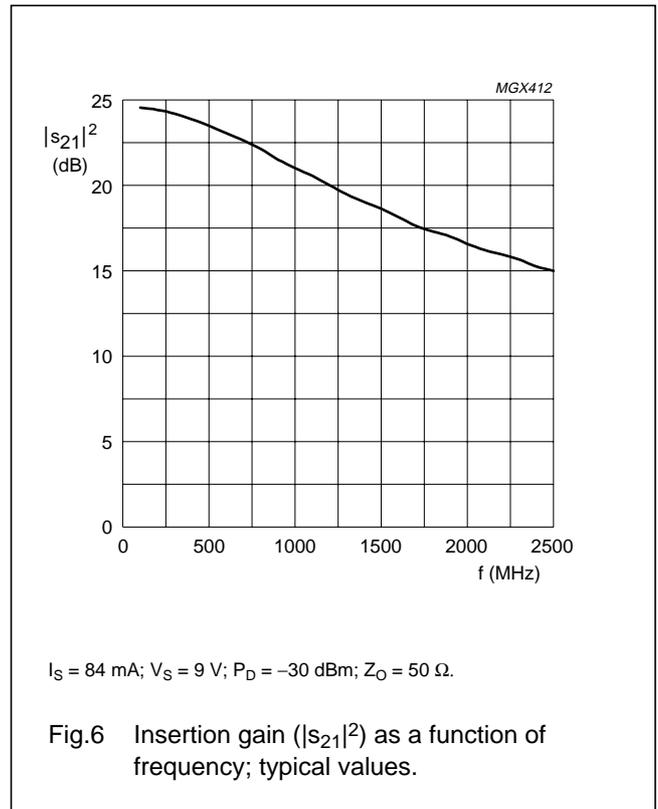
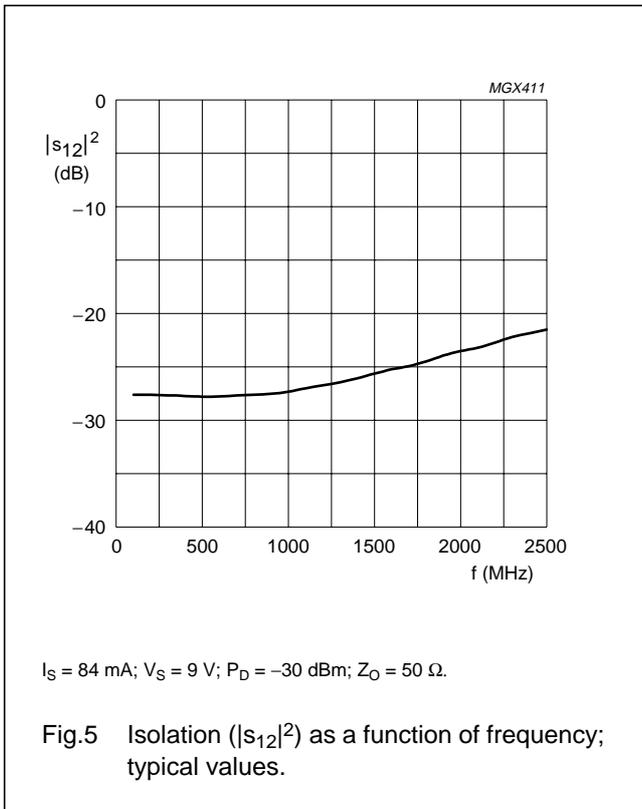


$I_S = 84 \text{ mA}$ ;  $V_S = 9 \text{ V}$ ;  $P_D = -30 \text{ dBm}$ ;  $Z_O = 50 \Omega$ .

Fig.4 Output reflection coefficient ( $s_{22}$ ); typical values.

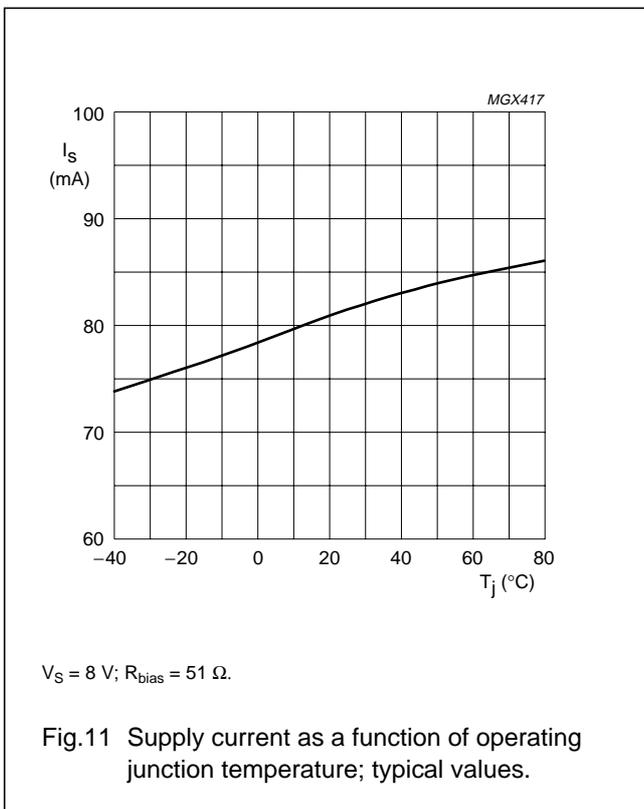
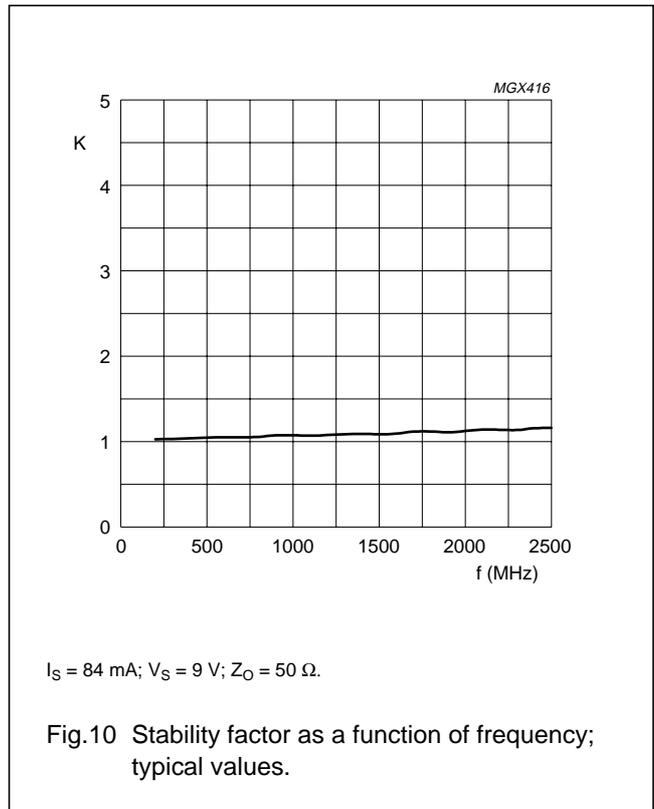
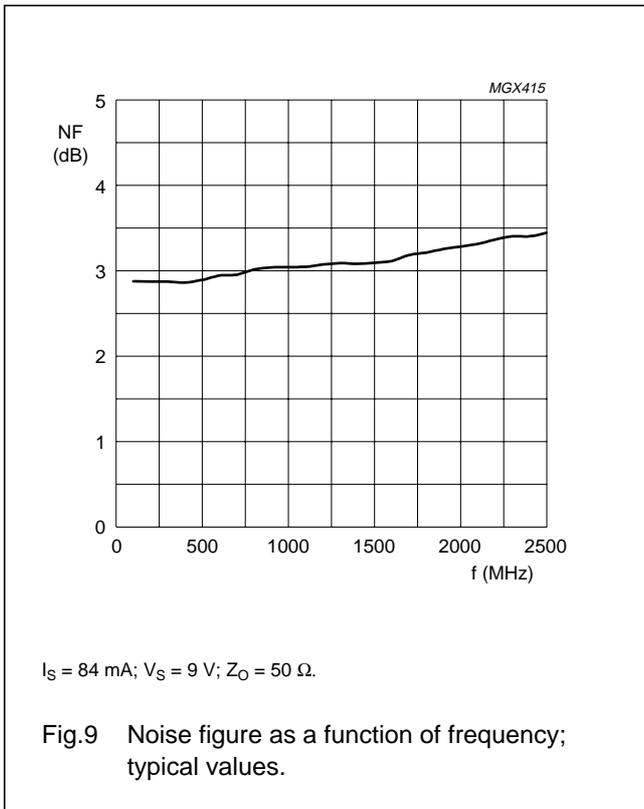
MMIC wideband medium power amplifier

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MMIC wideband medium power amplifier

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## MMIC wideband medium power amplifier

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## Scattering parameters

 $I_S = 83 \text{ mA}$ ;  $V_S = 8 \text{ V}$ ;  $P_D = -30 \text{ dBm}$ ;  $Z_O = 50 \Omega$ ;  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ 

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>		K-FACTOR
	MAGNITUDE (ratio)	ANGLE (deg)							
200	0.30	-6.87	16.61	161.86	0.04	2.38	0.34	-20.03	1.0
300	0.31	-10.91	16.18	153.02	0.04	3.66	0.34	-30.50	1.0
400	0.32	-15.72	15.59	144.39	0.04	5.17	0.34	-40.74	1.1
500	0.33	-21.0	14.91	136.01	0.04	6.75	0.34	-50.56	1.1
600	0.33	-26.44	14.19	128.12	0.04	8.67	0.34	-60.07	1.1
700	0.34	-32.08	13.51	120.88	0.04	10.94	0.33	-69.21	1.1
800	0.34	-37.75	12.77	114.19	0.04	13.65	0.33	-77.91	1.1
900	0.35	-43.18	11.88	107.40	0.04	15.15	0.32	-86.13	1.1
1000	0.35	-48.9	11.22	101.34	0.04	17.89	0.32	-94.01	1.1
1100	0.35	-54.2	10.64	95.86	0.04	19.93	0.31	-101.7	1.1
1200	0.35	-59.55	10.0	90.82	0.05	22.11	0.30	-109.1	1.1
1300	0.34	-64.78	9.39	85.46	0.05	24.10	0.30	-116.4	1.1
1400	0.34	-69.93	8.93	80.15	0.05	24.62	0.29	-123.6	1.1
1500	0.33	-74.81	8.54	75.95	0.05	25.98	0.28	-130.9	1.1
1600	0.33	-79.82	8.07	72.26	0.05	27.67	0.27	-138.2	1.1
1700	0.32	-84.88	7.60	67.95	0.06	28.69	0.26	-145.7	1.1
1800	0.31	-89.81	7.32	63.43	0.06	28.33	0.25	-153.6	1.1
1900	0.30	-94.89	7.08	59.81	0.06	28.44	0.24	-162.0	1.1
2000	0.29	-100.3	6.74	56.09	0.07	29.27	0.23	-170.7	1.1
2100	0.28	-105.9	6.46	51.84	0.07	29.17	0.23	179.99	1.1
2200	0.26	-111.8	6.28	48.02	0.07	28.46	0.22	170.17	1.2
2300	0.25	-118.0	6.07	45.0	0.08	28.37	0.22	160.16	1.2
2400	0.24	-125.2	5.78	41.33	0.08	28.17	0.22	149.59	1.1
2500	0.22	-132.8	5.61	36.72	0.08	26.46	0.23	139.39	1.2
2600	0.21	-141.3	5.51	33.15	0.09	24.85	0.24	129.67	1.0
2700	0.21	-153.3	5.33	30.04	0.09	24.72	0.28	120.55	1.2
2800	0.07	-127.7	6.44	28.98	0.12	24.46	0.28	80.88	1.2
2900	0.19	-167.20	4.88	19.14	0.10	20.48	0.27	105.15	1.2
3000	0.18	178.11	4.78	16.89	0.10	19.71	0.30	96.35	1.2
3100	0.18	165.13	4.57	16.56	0.11	18.98	0.32	89.48	1.0

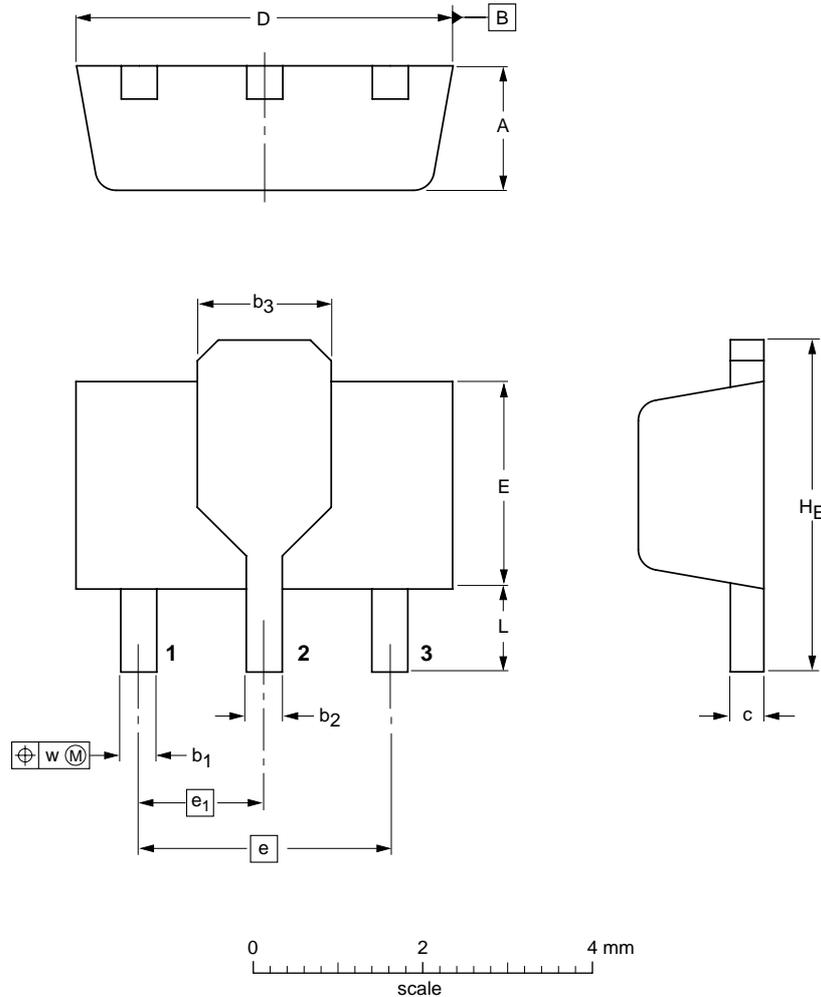
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PACKAGE OUTLINE

Plastic surface mounted package; collector pad for good heat transfer; 3 leads

SOT89



DIMENSIONS (mm are the original dimensions)

UNIT	A	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L min.	w
mm	1.6 1.4	0.48 0.35	0.53 0.40	1.8 1.4	0.44 0.37	4.6 4.4	2.6 2.4	3.0	1.5	4.25 3.75	0.8	0.13

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT89		TO-243	SC-62		97-02-28 99-09-13

## MMIC wideband medium power amplifier

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