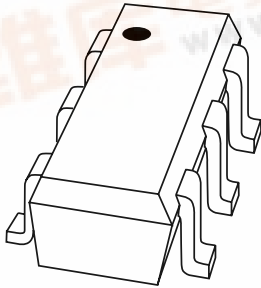


**DISCRETE SEMICONDUCTORS**

# DATA SHEET



## **BGA2031/1** **MMIC variable gain amplifier**

Preliminary specification

2000 Feb 17

# MMIC variable gain amplifier

# BGA2031/1

## FEATURES

- High gain
- Excellent adjacent channel power rejection
- Small SMD package
- Low dissipation.

## APPLICATIONS

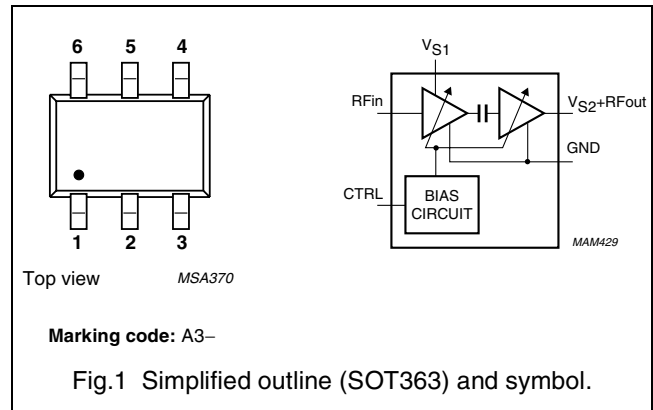
- General purpose variable gain amplifier for low voltage and medium power
- Driver for power amplifiers in systems that require good linearity, such as CDMA, both cellular band (850 MHz) and PCS (1.9 GHz). This is because of the high output power and good linearity.

## DESCRIPTION

Silicon Monolithic Microwave Integrated Circuit (MMIC) 2 stage variable gain amplifier in double polysilicon technology in a 6-pin SOT363 plastic SMD package for low voltage medium power applications.

## PINNING

PIN	DESCRIPTION
1	RF in
2	CTRL
3	V <sub>S1</sub>
4	V <sub>S2</sub> + RF out
5	GND
6	GND



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V <sub>S1</sub> , V <sub>S2</sub>	supply voltages		3	3.3	V
I <sub>S</sub>	supply current into pin 3 + pin 4	V <sub>CTRL</sub> = 0	0	10	μA
		V <sub>CTRL</sub> = 2.7 V; V <sub>S</sub> = 3 V	51	63	mA
		V <sub>CTRL</sub> = 2.4 V; V <sub>S</sub> = 3 V	30	37	mA
P <sub>L</sub>	load power	at 1 dB gain compression point; f = 1.9 GHz	13	–	dBm
ACPR	adjacent channel power rejection	f = 1.9 GHz; P <sub>L</sub> = 10 dBm	49	–	dBc
		f = 836 MHz; P <sub>L</sub> = 8 dBm	48	–	dBc
G <sub>p</sub>	power gain	f = 1.9 GHz; P <sub>L</sub> = 12 dBm	23	–	dB
		f = 836 MHz; P <sub>L</sub> = 8 dBm	24	–	dB
ΔG	gain control range	f = 836 MHz; P <sub>L</sub> = 8 dBm	62	–	dB

## 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.

## MMIC variable gain amplifier

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**LIMITING VALUES**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_S$	DC supply voltage		–	3.3	V
$V_{CTRL}$	control voltage		–	$< V_S$	V
$I_{CTRL}$	control current		–	1.2	mA
$I_{S1}$	current into pin 3		–	27	mA
$I_{S2}$	current into pin 4		–	50	mA
$P_D$	drive power		–	tbf	dBm
$P_{tot}$	total power dissipation	$T_s \leq 80\text{ }^\circ\text{C}$	–	200	mW
$T_{stg}$	storage temperature		–65	+150	$^\circ\text{C}$
$T_j$	operating junction temperature		–	150	$^\circ\text{C}$

**THERMAL RESISTANCE**

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

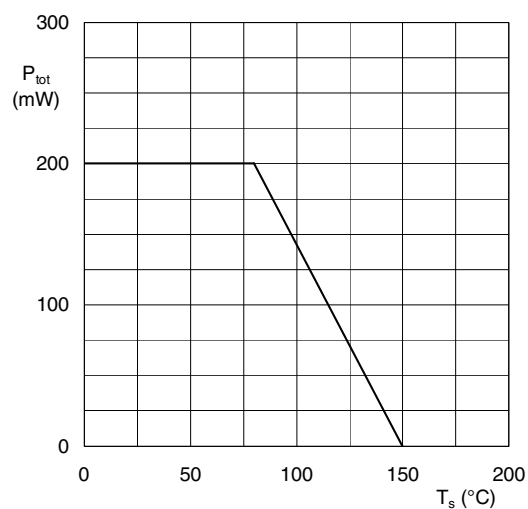


Fig.2 Power derating.

## MMIC variable gain amplifier

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## CHARACTERISTICS

 $T_j = 25\text{ }^\circ\text{C}$ ;  $Z_S = Z_L = 50\text{ }\Omega$ ;  $V_S = 3\text{ V}$ ; unless otherwise specified.

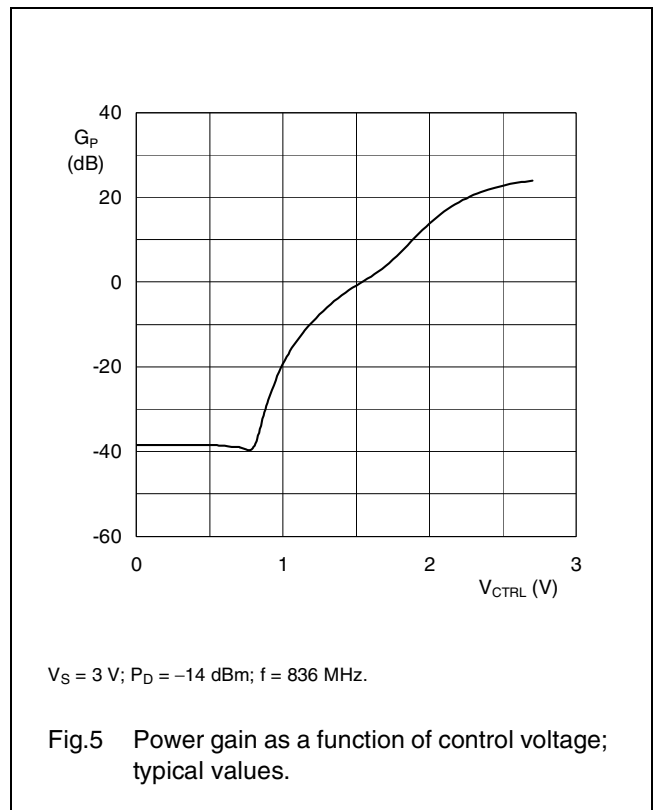
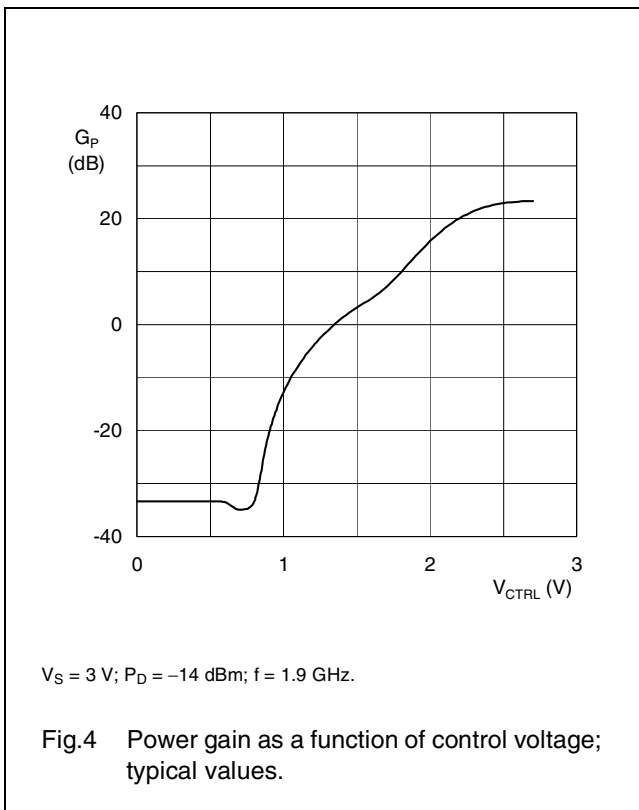
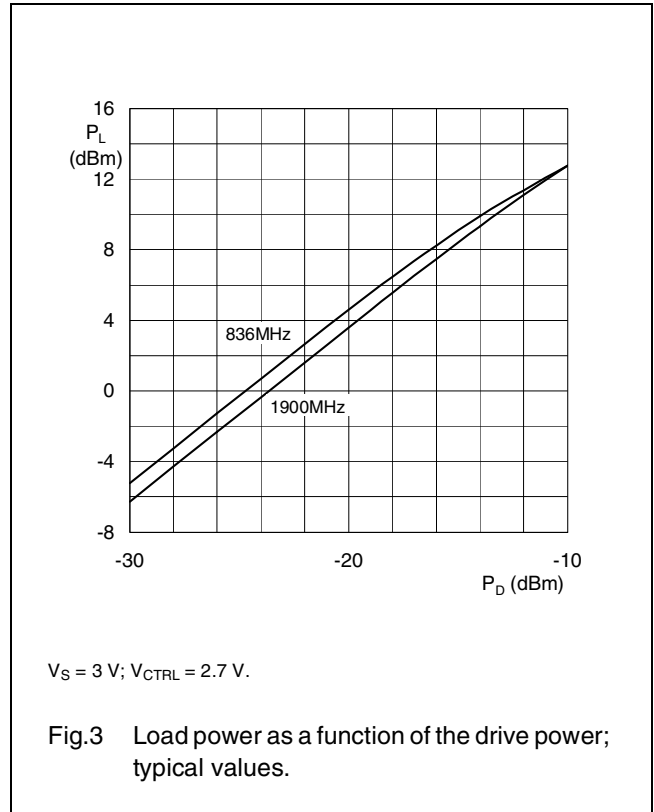
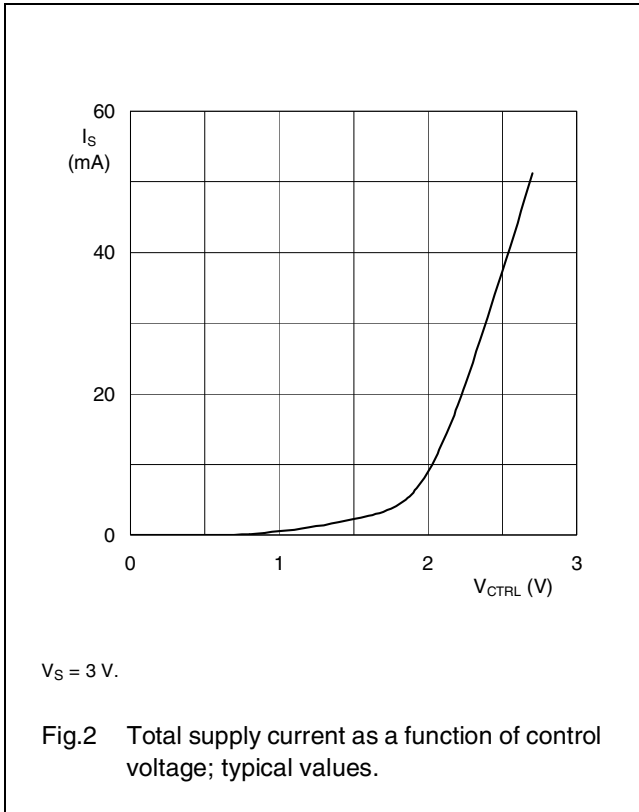
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range		800	–	2500	MHz
$V_{S1}, V_{S2}$	supply voltages		2.7	3	3.3	V
$I_S$	supply current (in pin 3 + pin 4)	$V_{CTRL} = 0$ ; $P_D = 0\text{ mW}$	–	0	10	$\mu\text{A}$
		$V_{CTRL} = 2.7\text{ V}$ ; $V_S = 3\text{ V}$ ; $P_D = 0\text{ mW}$	37	51	63	mA
		$V_{CTRL} = 2.4\text{ V}$ ; $V_S = 3\text{ V}$ ; $P_D = 0\text{ mW}$	23	30	37	mA
$I_{CTRL}$	control current	$V_{CTRL} = 2.7\text{ V}$	0.7	0.92	1.1	mA
<b>f = 1900 MHz</b>						
f	frequency range		1850	–	1950	MHz
$G_P$	power gain	$V_{CTRL} = 2.7\text{ V}$ ; $P_L = 12\text{ dBm}$	–	23	–	dB
$\Delta G$	gain control range	$0 < V_{CTRL} < 2.7\text{ V}$	–	56	–	dB
$G_{CS}$	gain control slope	note 1	–	21	–	dB/V
ACPR	adjacent channel power rejection	$\pm 1.23\text{ MHz}$ offset; $BW_{ACP} = 30\text{ kHz}$ ; $BW_{carrier} = 1.23\text{ MHz}$ ; $P_L = 10\text{ dBm}$	–	49	–	dBc
		$\pm 1.98\text{ MHz}$ offset; $BW_{ACP} = 30\text{ kHz}$ ; $BW_{carrier} = 1.23\text{ MHz}$ ; $P_L = 10\text{ dBm}$	–	74	–	dBc
$P_L$	load power	at 1 dB gain compression point	–	13	–	dBm
$P_N$	noise power	in CDMA receive band (1895 – 1955 MHz)	–	tbf	–	dBm/Hz
$VSWR_{IN}$	input VSWR	$V_{CTRL} = 2.7\text{ V}$	–	1:3.5	–	
$VSWR_{OUT}$	output VSWR	$V_{CTRL} = 2.7\text{ V}$	–	1:1.3	–	
<b>f = 836 MHz</b>						
f	frequency range		824	–	849	MHz
$G_P$	power gain	$V_{CTRL} = 2.7\text{ V}$ ; $P_L = 8\text{ dBm}$	–	24	–	dB
$\Delta G$	gain control range	$0 < V_{CTRL} < 2.7\text{ V}$	–	62	–	dB
$G_{CS}$	gain control slope	note 1	–	22	–	dB/V
ACPR	adjacent channel power rejection	$\pm 885\text{ kHz}$ offset; $BW_{ACP} = 30\text{ kHz}$ ; $BW_{carrier} = 1.23\text{ MHz}$ ; $P_L = 8\text{ dBm}$	–	49	–	dBc
		$\pm 1.98\text{ MHz}$ offset; $BW_{ACP} = 30\text{ kHz}$ ; $BW_{carrier} = 1.23\text{ MHz}$ ; $P_L = 8\text{ dBm}$	–	74	–	dBc
$P_L$	load power	at 1 dB gain compression point	–	11	–	dBm
$P_N$	noise power	in CDMA receive band (869 to 894 MHz)	–	tbf	–	dBm/Hz
$VSWR_{IN}$	input VSWR	$V_{CTRL} = 2.7\text{ V}$	–	1:2	–	
$VSWR_{OUT}$	output VSWR	$V_{CTRL} = 2.7\text{ V}$	–	1:1.4	–	

## Notes

- $G_{CS} = (G @ V_{ctrl} = 2.5\text{ V} - G @ V_{ctrl} = 1.5\text{ V}) / (V_{ctrl} = 2.5\text{ V} - V_{ctrl} = 1.5\text{ V})$

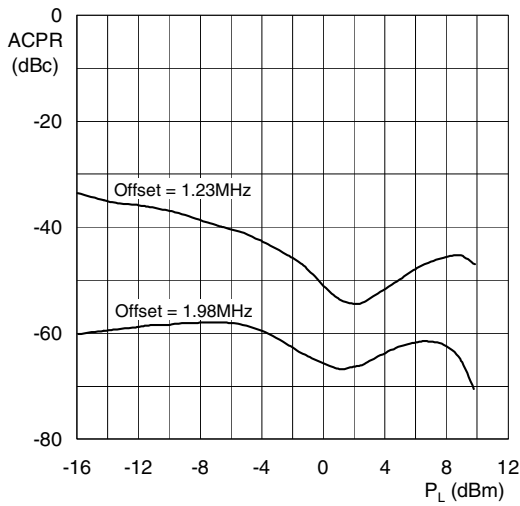
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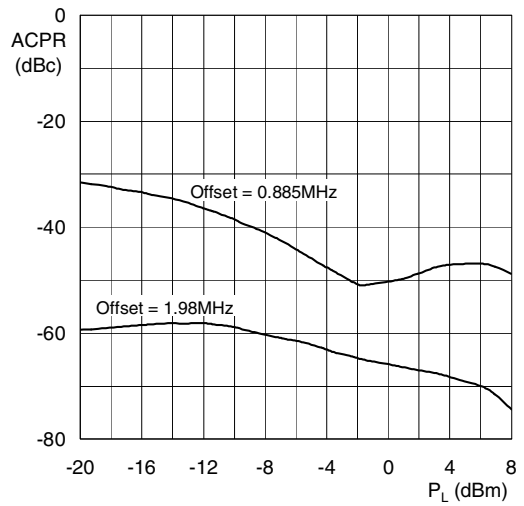
MMIC variable gain amplifier

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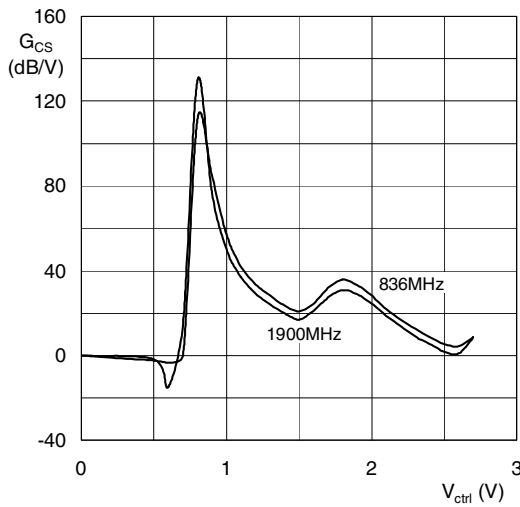
$V_S = 3\text{ V}$ ;  $f = 1.9\text{ GHz}$ ;  $P_D = -12.8\text{ dBm}$ .

Fig. 6 Adjacent channel power rejection as a function of the load power; typical values.



$V_S = 3.6\text{ V}$ ;  $f = 836\text{ MHz}$ ;  $P_D = -16\text{ dBm}$ .

Fig. 7 Adjacent channel power rejection as a function of the load power; typical values.



$V_S = 3\text{ V}$ ;  $P_D = -14\text{ dBm}$ .

Fig. 8 Gain control slope as a function of the control voltage; typical values.

MMIC variable gain amplifier

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ELECTRICAL BLOCK DIAGRAM

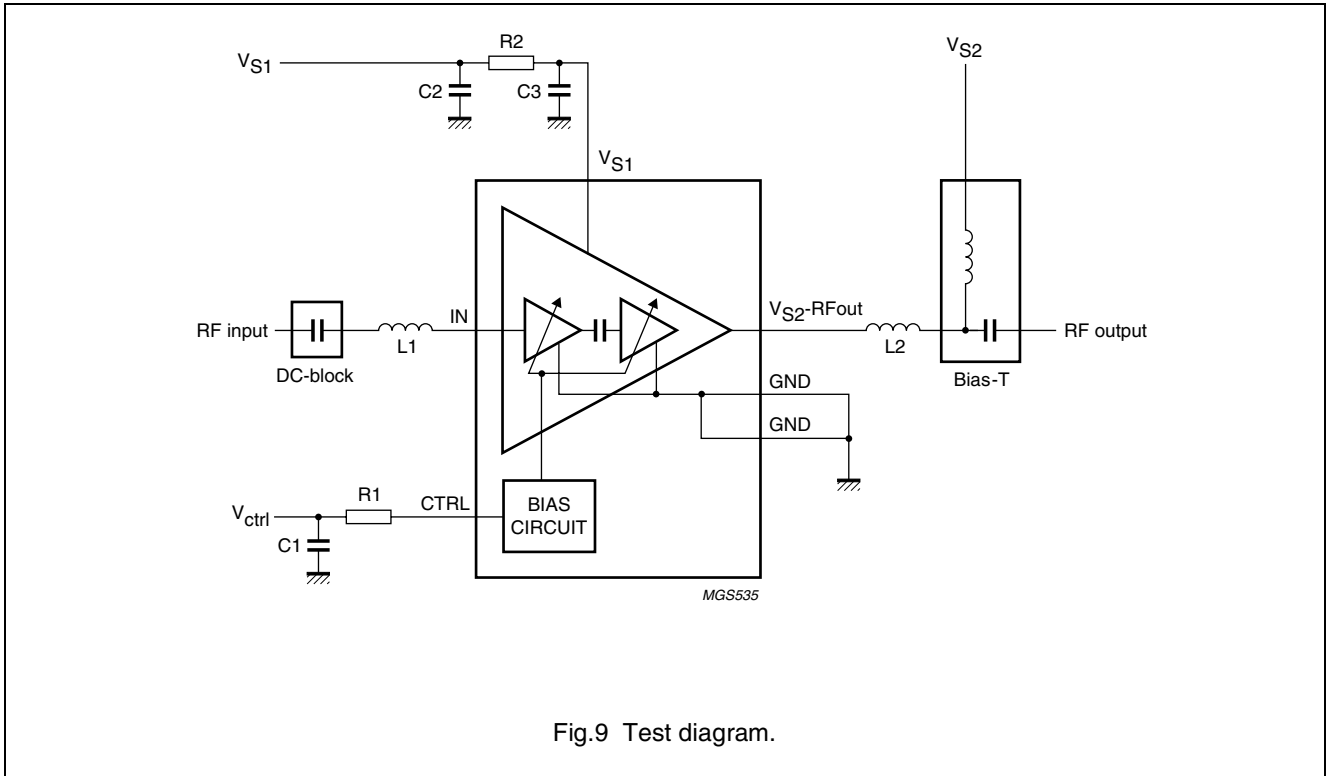


Fig.9 Test diagram.

List of components (see Fig.3)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	multilayer ceramic chip capacitor	10 nF	0603	tbf
C2	multilayer ceramic chip capacitor	22 nF	0603	tbf
C3	multilayer ceramic chip capacitor	1.5 nF	0603	tbf
L1, L2	stripline; note 1	50 Ω		tbf
R1	SMD resistor	22 Ω; 0.16 W	0603	tbf
R2	SMD resistor	2.4 Ω; 0.16 W	0603	tbf

Note

1. The striplines are 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  $\mu\text{m}$ .

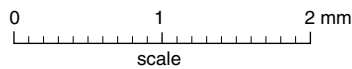
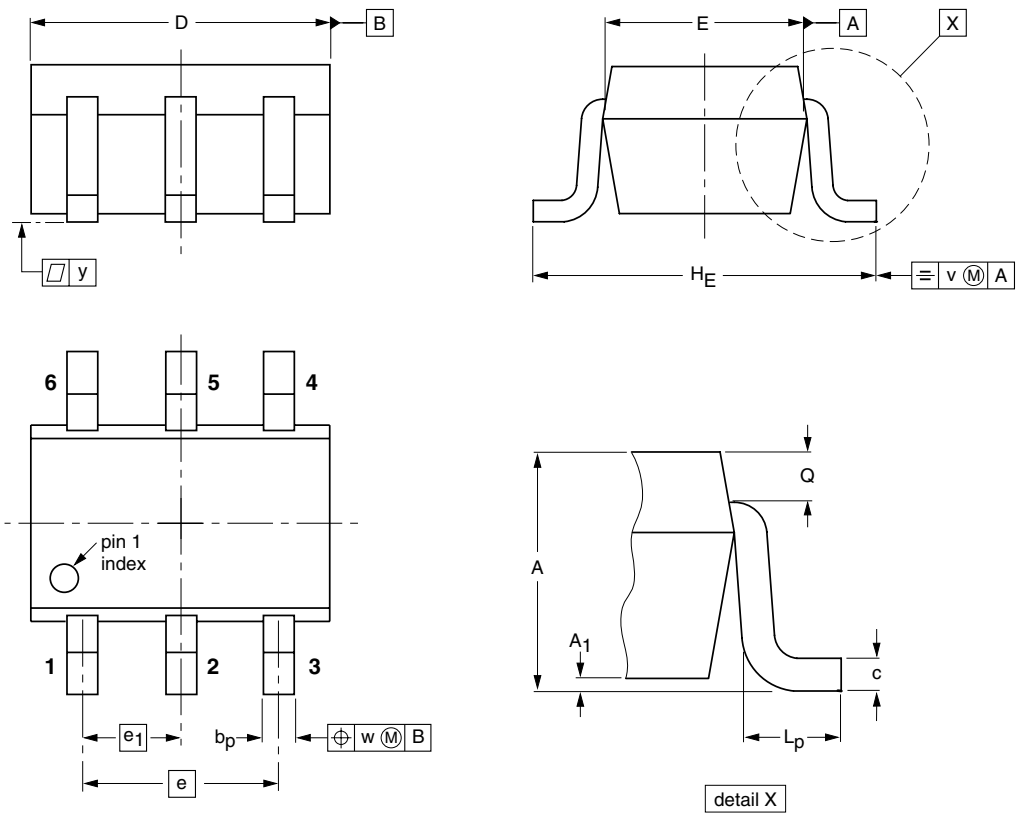
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PACKAGE OUTLINE

Plastic surface mounted package; 6 leads

SOT363



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> 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 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

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



## MMIC variable gain 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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