UA2725

Gain Block

Data Sheet

DS-2725-01

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Version: 1.0
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Gain Block

1. Product Description

The UA2725 is a wideband LNA MMIC with an internal input/output matching, high/low gain control, and packaged in a 6-pin SOT363 plastic package.

2. Features

- ❑ Single 3.3V power supply
- ❑ Internally matched to 50Ω
- ❑ Low noise figure: 1.9dB at 2.5GHz, 1.6dB at 0.4GHz.
- ❑ Very wide frequency over 0.05 to 4GHz
- ❑ Flat 20dB gain up to 2.2GHz
- ❑ Unconditionally stable
- ❑ P1dB over -1.5dBm at 2.5GHz
- ❑ High/Low gain control

3. Typical Applications

- ❑ DBS
- ❑ LNB IF Amplifier
- ❑ DVB
- ❑ Cable
- ❑ ISM
- ❑ General Purpose

4. Pin Configuration

Table 1. Pin Descriptions

Pin #	Description
1	V_{GC}
2, 5	GND1
3	RF out
4	GND2
6	RF in

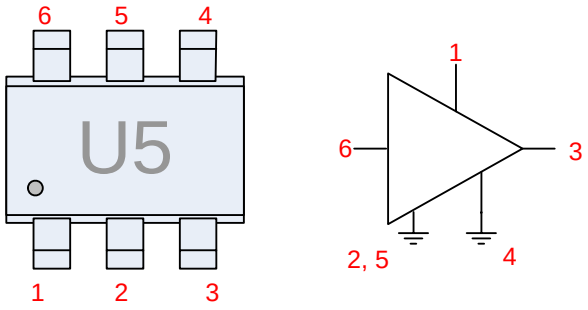

Figure 1. Simplified Outline (SOT363) and Symbol

5. Application Circuit

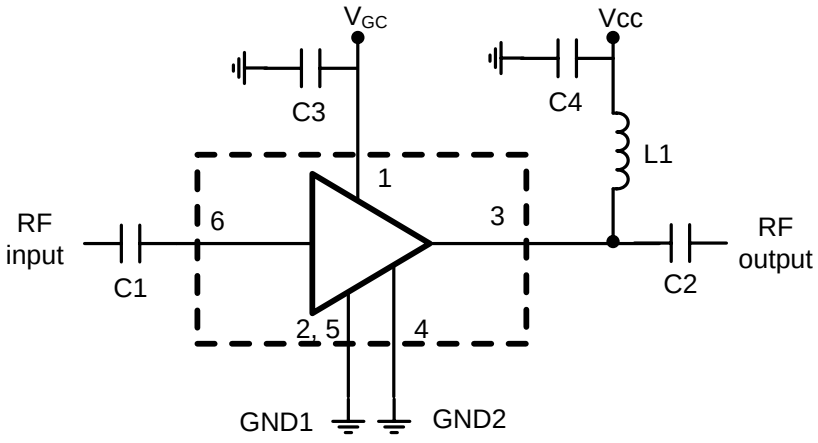

Figure 2. Operating Condition for the Application Circuit

C1=C2=100pF, C3=C4=0.1uF. The nominal value of the RF choke, L1 is 33nH. Increasing the inductor value will shift the curve towards the lower frequency region. The operating frequency can be lowered to 50 MHz when L1 is larger than 220nH.

6. PCB Layout Design Guide

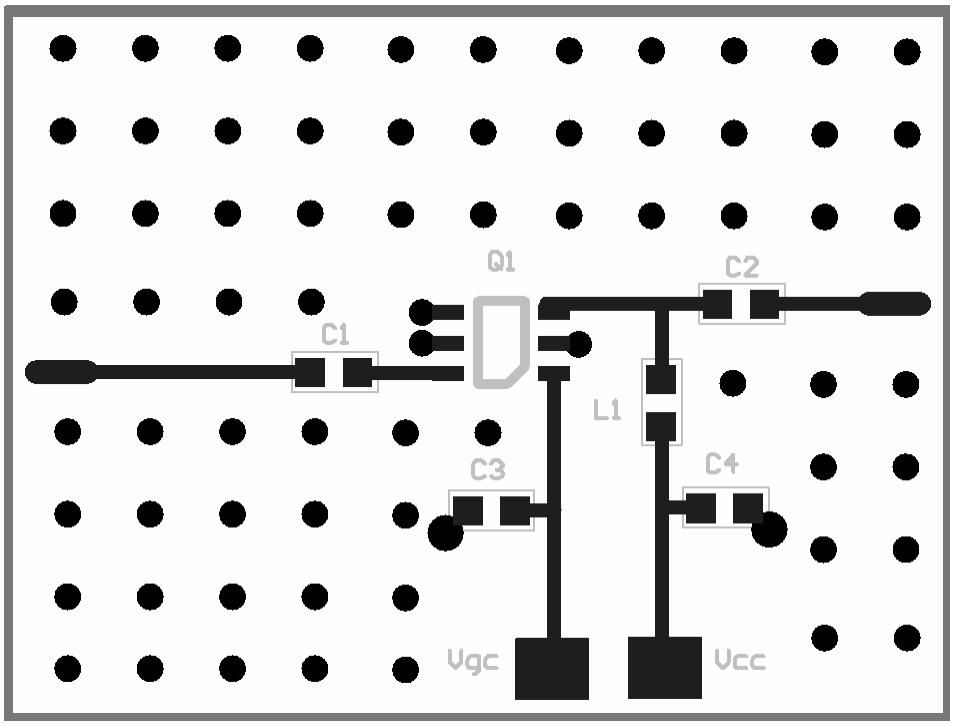

Figure 3. GND via hole

Notes:

1. Each ground pin must have individual via hole.
2. No DC or signal line on the bottom of IC

7. Operating Condition

Table 2. Absolute Maximum Ratings

Symbol	Parameters	Conditions	Typ.	Max.	Unit
Vcc	DC Supply Voltage	RF input AC coupled	-	4	V
Icc	Supply Current		-	30	mA
P_{tot}	Total Power Dissipation	$T_a \leqq 90$ ℃	-	120	mW
T_{st}	Storage Temperature		-65	150	℃
T_j	Operating Junction Temperature		-40	150	℃
P_D	Maximum Drive Power		-	-5	dBm

Table 3. Thermal Characteristics

Symbol	Parameters	Conditions	Value	Unit
R_{th}	Thermal Resistance from Junction to Solder Point	P_{tot} = 85 mW; $T_a \leqq 90$ ℃	300	K/W

8. Electrical Characteristics

Table 4. High/Low Gain Control Pin

State	Pin 1	Chapter
High Gain Mode	V_{GC} = 3.3 V	8.1.
Low Gain Mode	V_{GC} = 0 V	8.2.

8.1. High Gain Mode

Table 5. Electrical Characteristics with L1 = 33nH

Vcc = 3.3V; Icc = 12mA; V_{GC} = 3.3V; unless otherwise specified.

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Unit
Icc	Supply Current		-	12	-	mA
$\|S_{21}\|^2$	Insertion Power Gain	f = 400 MHz	-	19.5	-	dB
		f = 0.9 GHz	-	20	-	dB
		f = 2.5 GHz	-	20	-	dB
		f = 3 GHz	-	19.5	-	dB
		f = 4 GHz	-	17	-	dB
$\|S_{11}\|^2$	Input Return Loss	f = 0.4 GHz	10	-	-	dB
		f = 2.5 GHz	10	-	-	dB
		f = 4 GHz	10	-	-	dB
$\|S_{22}\|^2$	Output Return Loss	f = 0.4 GHz	10	-	-	dB
		f = 2.5 GHz	10	-	-	dB
		f = 4 GHz	10	-	-	dB
$\|S_{12}\|^2$	Isolation	f = 0.4 GHz	-	31	-	dB
		f = 2.5 GHz	-	31.5	-	dB
		f = 4 GHz	-	34	-	dB
NF	Noise Figure	f = 0.4 GHz	-	1.6	-	dB
		f = 2.5 GHz	-	1.9	-	dB
		f = 4 GHz	-	2.6	-	dB
BW	Bandwidth	at $\|S_{21}\|^2$-3 dB below flat gain at 1 GHz	-	3.9	-	GHz
K	Stability Factor	f = 0.9 GHz	-	2	-	-
		f = 2.5 GHz	-	2	-	-
$P_{L(sat)}$	Saturated Load Power	f = 0.9 GHz	-	5	-	dBm
		f = 2.5 GHz	-	4	-	dBm
$P_{L,1dB}$	Output P_{1dB}	at 1 dB gain compression; f = 0.9 GHz	-	-1	-	dBm
		at 1 dB gain compression; f = 2.5 GHz	-	-1.5	-	dBm
I_{GC}	Control Current	V_{GC}=3.3V	-	0.9	-	mA

Caution: ESD sensitive.

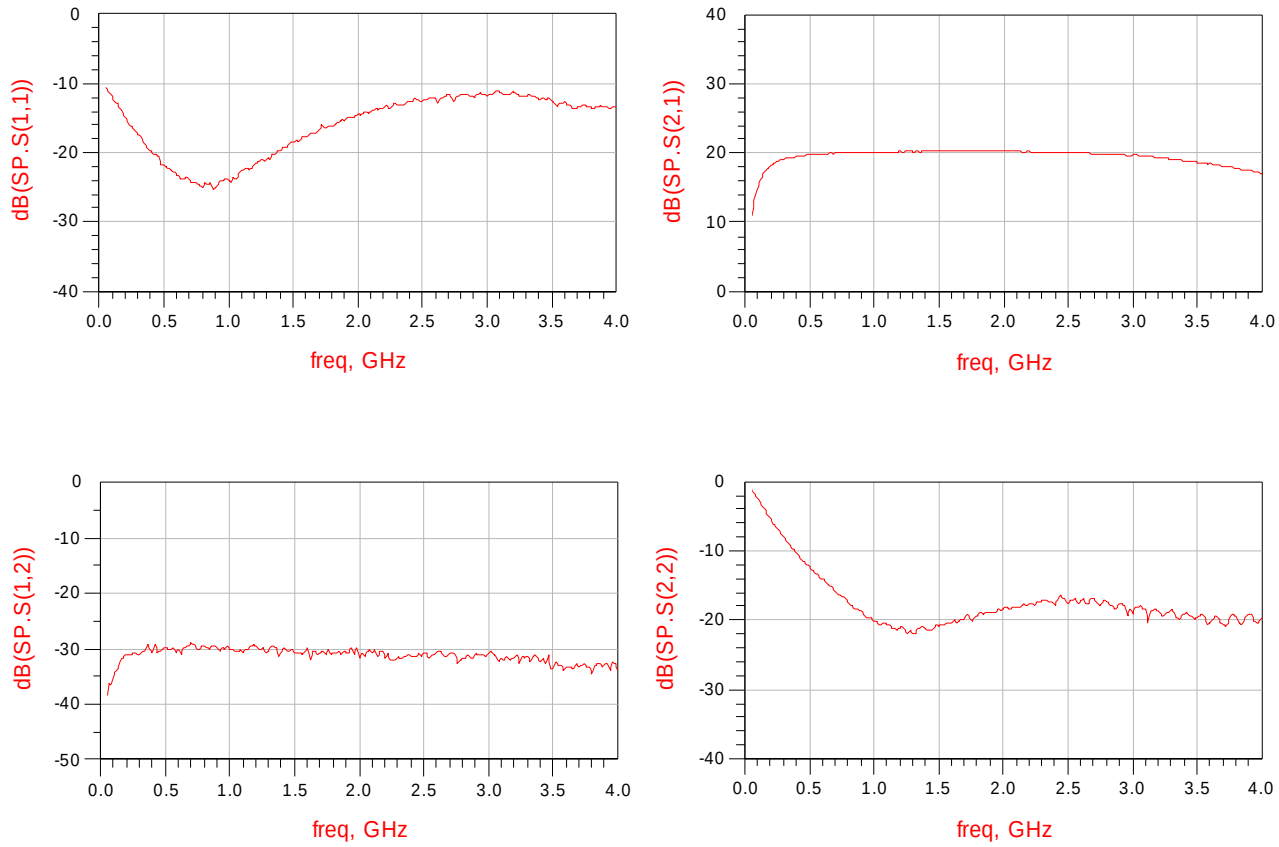

Figure 4. S-parameter (V_{cc}=3.3V, I_{cc}=12mA, V_{GC} = 3.3V, P_{in}=-40dBm, Z_O=50Ω) with L1=33nH

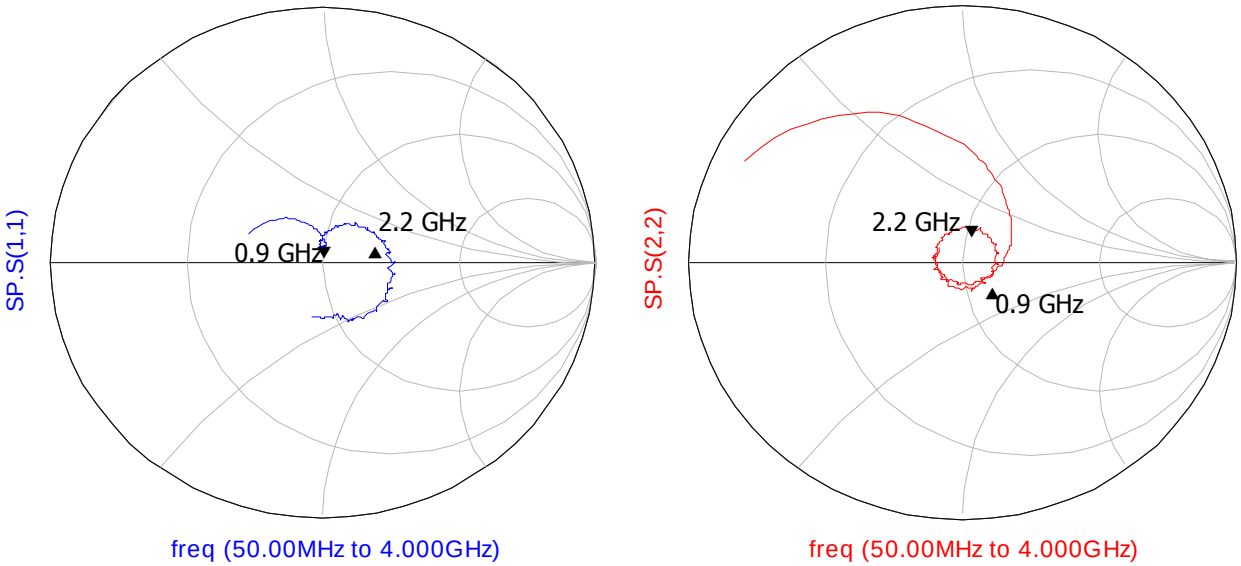

Figure 5. S_{11} & S_{22} (V_{cc}=3.3V, I_{cc}=12mA, V_{GC} = 3.3V, P_{in}=-40dBm, Z_O=50Ω) with L1=33nH

Table 6. Electrical Characteristics with L1=120nH (High gain mode)

Vcc = 3.3V; Icc = 12mA; V_{GC} = 3.3V; unless otherwise specified.

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Unit
Icc	Supply Current		-	12	-	mA
$\|S_{21}\|^2$	Insertion Power Gain	f = 100 MHz	-	19.4	-	dB
		f = 0.5 GHz	-	19.7	-	dB
		f = 0.9 GHz	-	19.7	-	dB
		f = 1.5 GHz	-	19.7	-	dB
		f = 2 GHz	-	19.6	-	dB
$\|S_{11}\|^2$	Input Return Loss	f = 100MHz	10	-	-	dB
		f = 0.9 GHz	10	-	-	dB
		f = 2 GHz	10	-	-	dB
$\|S_{22}\|^2$	Output Return Loss	f = 100 MHz	10	-	-	dB
		f = 0.9 GHz	10	-	-	dB
		f = 2 GHz	10	-	-	dB
$\|S_{12}\|^2$	Isolation	f = 100 MHz	-	30	-	dB
		f = 0.9 GHz	-	30	-	dB
		f = 2 GHz	-	31	-	dB
NF	Noise Figure	f = 100 MHz	-	1.5	-	dB
		f = 0.9 GHz	-	1.6	-	dB
		f = 2 GHz	-	1.8	-	dB
BW	Bandwidth	at $\|S_{21}\|^2$-3 dB below flat gain at 0.9 GHz	-	3.2	-	GHz
K	Stability Factor	f = 100 MHz	-	2	-	-
		f = 2 GHz	-	1.8	-	-
$P_{L(sat)}$	Saturated Load Power	f = 100 MHz	-	5	-	dBm
		f = 2 GHz	-	4	-	dBm
$P_{L,1\ dB}$	Output P_{1dB}	at 1 dB gain compression; f = 0.1 GHz	-	-1	-	dBm
		at 1 dB gain compression; f = 2 GHz	-	-1.5	-	dBm
I_{GC}	Control Current	V_{GC}=3.3V	-	0.9	-	mA

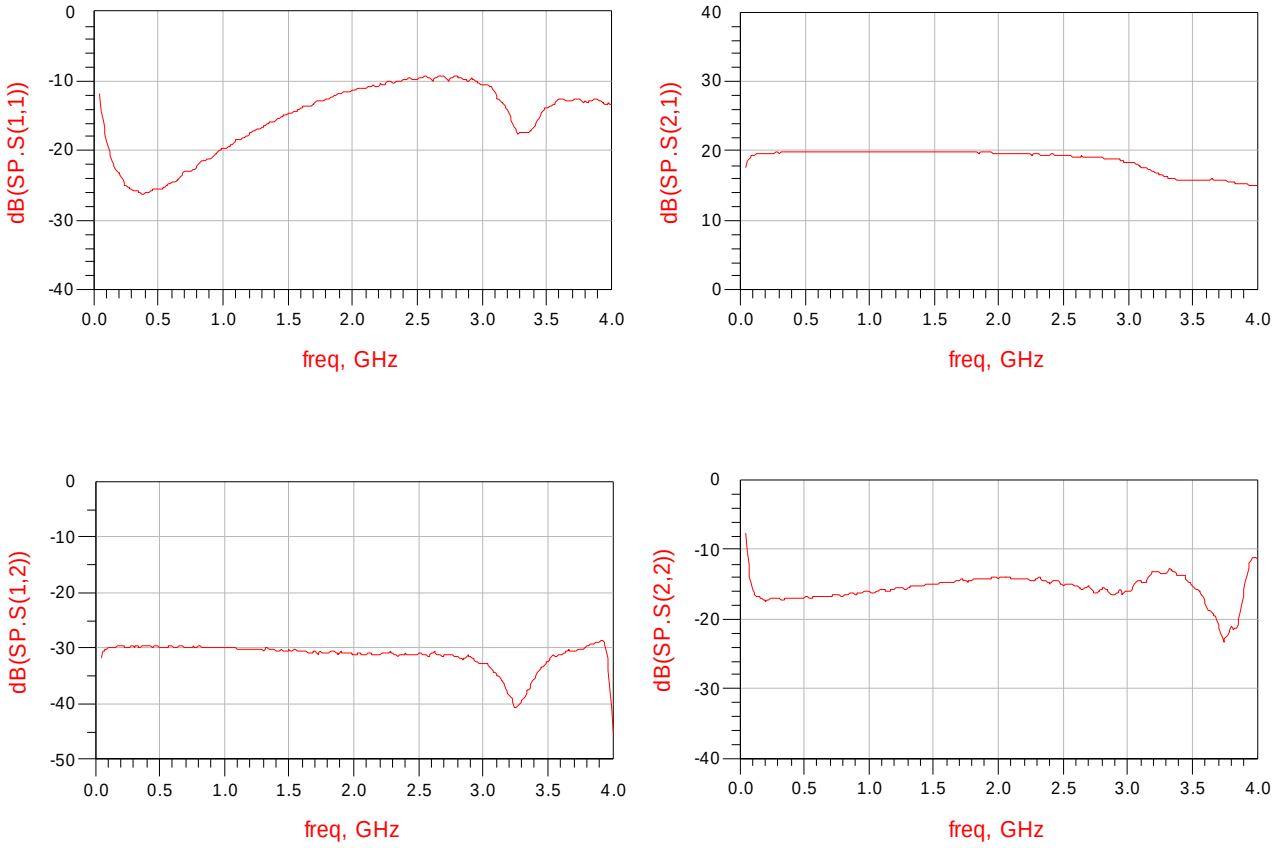

Figure 6. S-parameter (V_{cc}=3.3V, I_{cc}=12mA, V_{GC}=3.3V, P_{in}=-40dBm, Z_O=50Ω) with L1=120nH

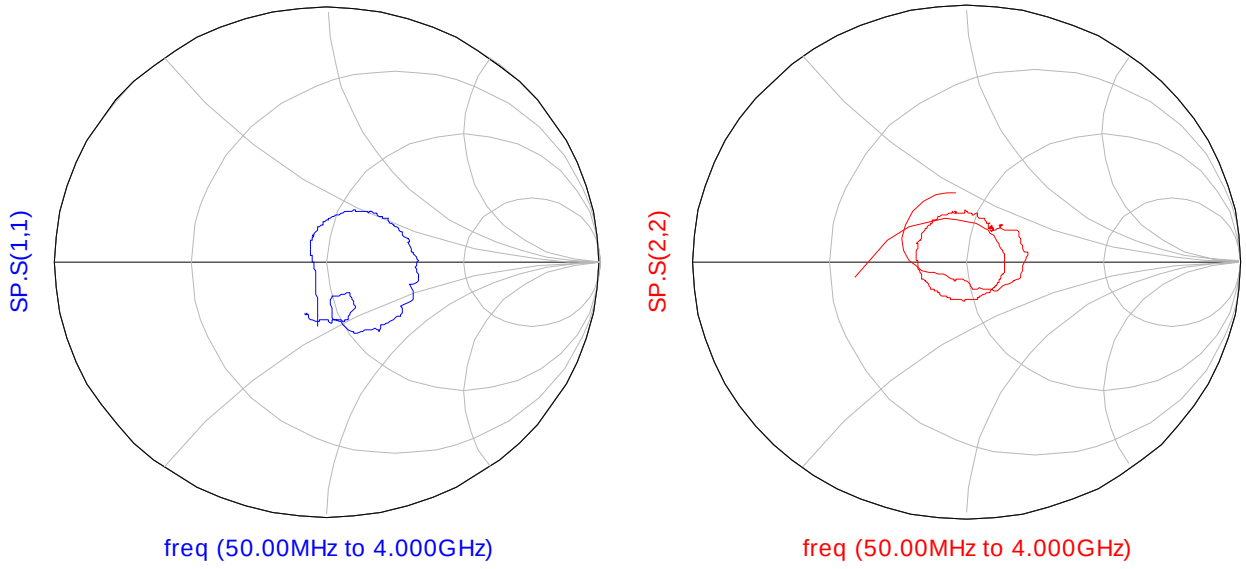

Figure 7. S_{11} & S_{22} (V_{cc}=3.3 V, I_{cc}=12mA, V_{GC}=3.3V, P_{in}=-40dBm, Z_O=50Ω) with L1=120nH

Table 7. Electrical Characteristics with L1=220nH

Vcc = 3.3V; Icc = 12mA; V_{GC} = 3.3V; unless otherwise specified.

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Unit
Icc	Supply Current		-	12	-	mA
$\|S_{21}\|^2$	Insertion Power Gain	f = 50 MHz	-	19	-	dB
		f = 100 MHz	-	19.5	-	dB
		f = 0.4 GHz	-	19.7	-	dB
		f = 0.9 GHz	-	19.7	-	dB
		f = 1.5 GHz	-	19.7	-	dB
$\|S_{11}\|^2$	Input Return Loss	f = 50MHz	10	-	-	dB
		f = 0.4 GHz	10	-	-	dB
		f = 1.5 GHz	10	-	-	dB
$\|S_{22}\|^2$	Output Return Loss	f = 50 MHz	10	-	-	dB
		f = 0.4 GHz	10	-	-	dB
		f = 1.5 GHz	10	-	-	dB
$\|S_{12}\|^2$	Isolation	f = 50 MHz	-	31	-	dB
		f = 0.4 GHz	-	30	-	dB
		f = 1.5 GHz	-	31	-	dB
NF	Noise Figure	f = 50 MHz	-	1.5	-	dB
		f = 0.4 GHz	-	1.6	-	dB
		f = 1.5 GHz	-	1.7	-	dB
BW	Bandwidth	at $\|S_{21}\|^2$-3 dB below flat gain at 0.5 GHz	-	2.5	-	GHz
K	Stability Factor	f = 50 MHz	-	2	-	-
		f = 0.9 GHz	-	1.9	-	-
$P_{L(sat)}$	Saturated Load Power	f = 50 MHz	-	5	-	dBm
		f = 0.9 GHz	-	4	-	dBm
$P_{L,1dB}$	Output P_{1dB}	at 1 dB gain compression; f = 50 MHz	-	-0.5	-	dBm
		at 1 dB gain compression; f = 0.9 GHz	-	-1	-	dBm
I_{GC}	Control Current	V_{GC}=3.3V	-	0.9	-	mA

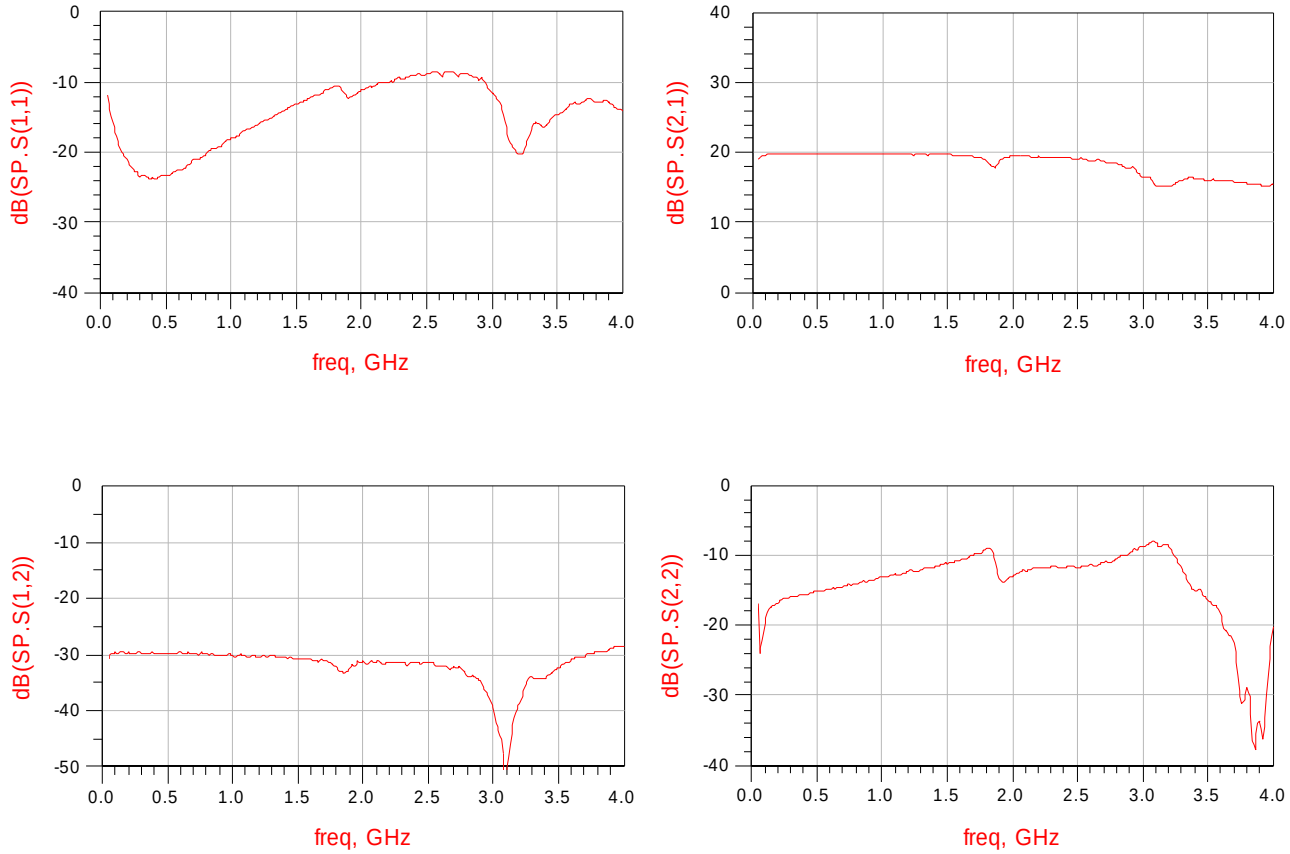

Figure 8. S-parameter (V_{cc}=3.3V, I_{cc}=12mA, V_{GC}=3.3V, P_{in}=-40dBm, Z_O=50Ω) with L1=220nH

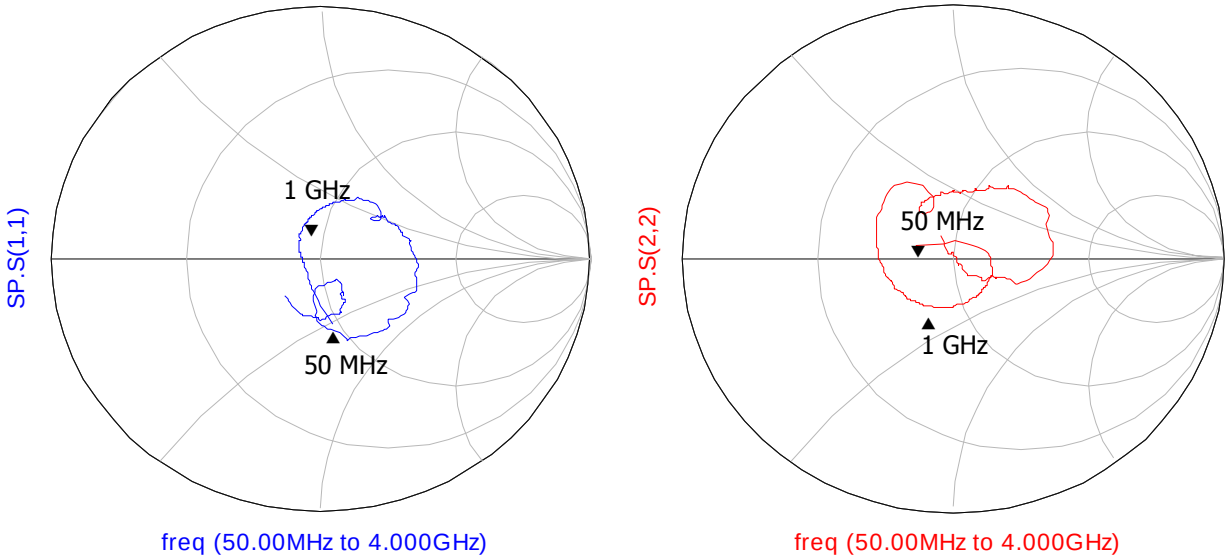

Figure 9. S_{11} & S_{22} (V_{cc}=3.3V, I_{cc}=12mA, V_{GC}=3.3V, P_{in}=-40dBm, Z_O=50Ω) with L1=220nH

8.2. Low Gain Mode

Table 8. Electrical Characteristics with L1=120nH

Vcc = 3.3V; Icc = 5mA; V_{GC} = 0V; unless otherwise specified.

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Unit
Icc	Supply Current		-	5	-	mA
$\|S_{21}\|^2$	Insertion Power Gain	f = 100 MHz	-	-18	-	dB
		f = 0.5 GHz	-	-17	-	dB
		f = 0.9 GHz	-	-17	-	dB
		f = 1.5 GHz	-	-18	-	dB
		f = 2 GHz	-	-18.5	-	dB
$\|S_{11}\|^2$	Input Return Loss	f = 100MHz	2	-	-	dB
		f = 0.9 GHz	2	-	-	dB
		f = 2 GHz	2	-	-	dB
$\|S_{22}\|^2$	Output Return Loss	f = 100 MHz	4.5	-	-	dB
		f = 0.9 GHz	4	-	-	dB
		f = 2 GHz	4	-	-	dB
$\|S_{12}\|^2$	Isolation	f = 100 MHz	-	20	-	dB
		f = 0.9 GHz	-	21	-	dB
		f = 2 GHz	-	23.5	-	dB
NF	Noise Figure	f = 100 MHz	-	1.6	-	dB
		f = 0.9 GHz	-	1.7	-	dB
		f = 2 GHz	-	1.8	-	dB
BW	Bandwidth	at $\|S_{21}\|^2$-3 dB below flat gain at 0.9 GHz	-	4.5	-	GHz
K	Stability Factor	f = 100 MHz	-	9.5	-	-
		f = 2 GHz	-	14.5	-	-
$P_{In,1dB}$	Output P_{1dB}	at 1 dB gain compression; f = 0.1 GHz	-	2	-	dBm
		at 1 dB gain compression; f = 2 GHz	-	0	-	dBm
I_{GC}	Control Current	V_{GC}=0V	-	-4	-	mA

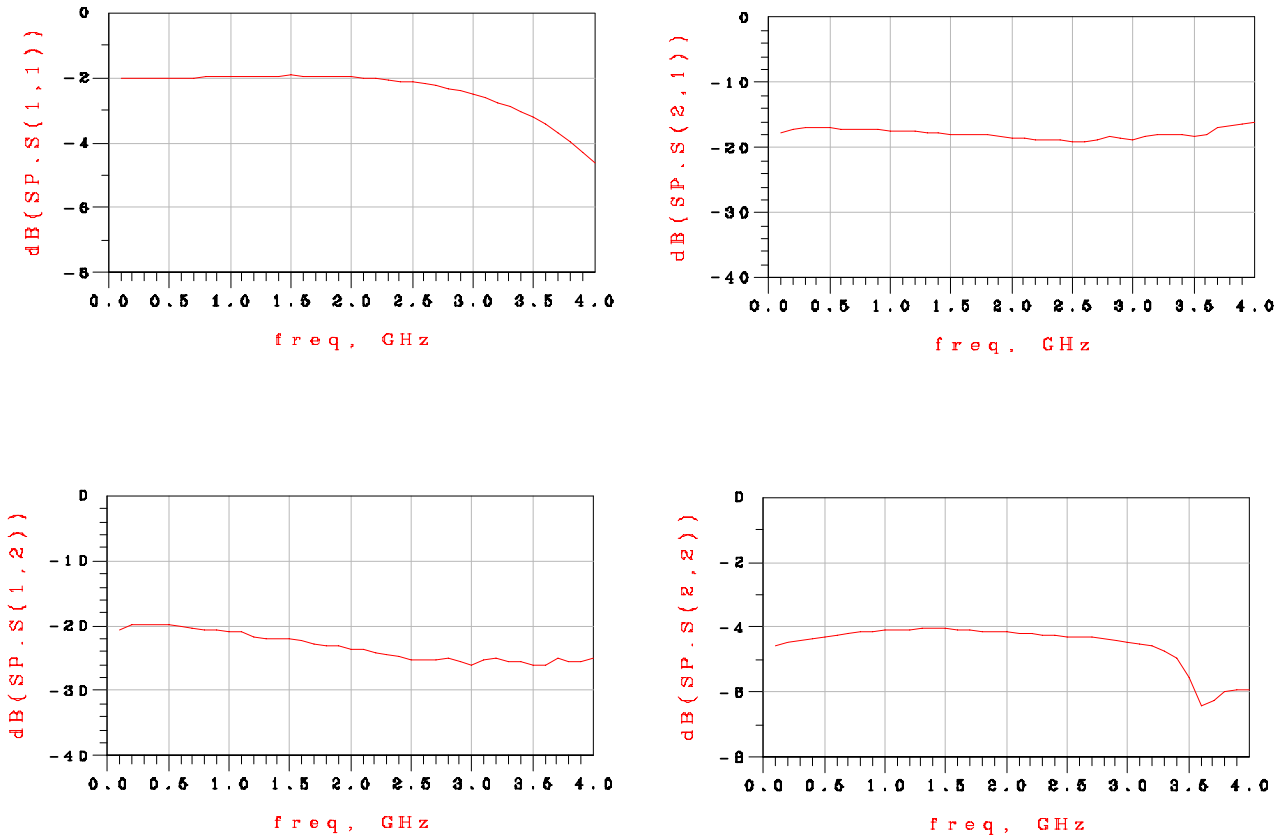

Figure 10. S-parameter (V_{cc}=3.3 V, I_{cc}=5mA, V_{GC}=0V, P_{in}=-40dBm, Z_O=50Ω) with L1=120nH

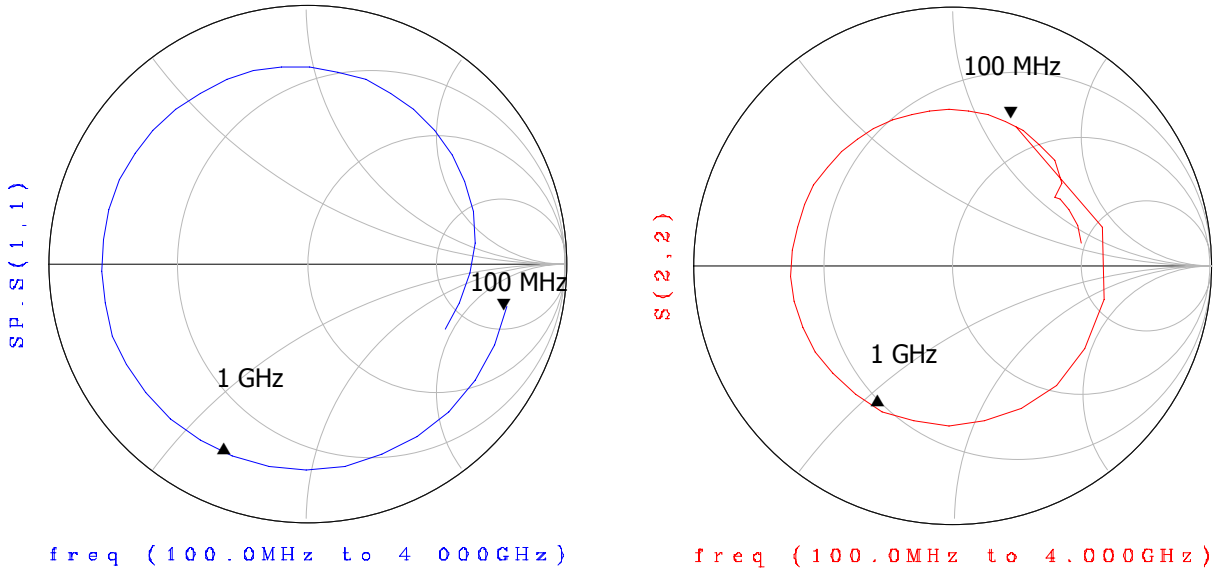

Figure 11. S_{11} & S_{22} (V_{cc}=3.3V, I_{cc}=5mA, V_{GC}=0V, P_{in}=-40dBm, Z_O=50Ω) with L1=120nH

9. Package Drawing

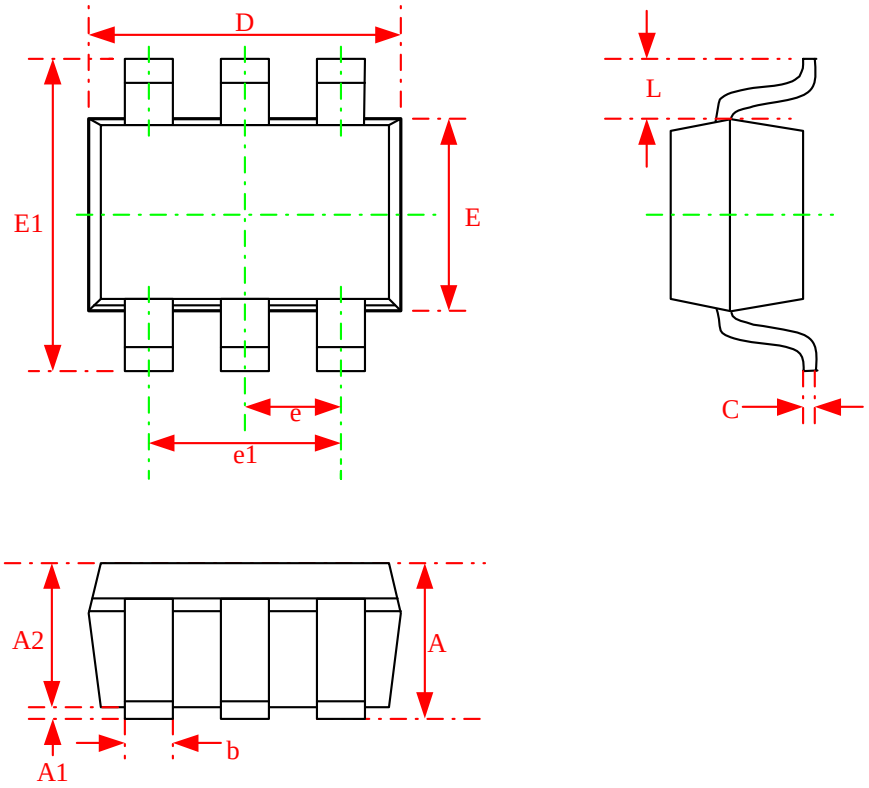

Figure 12. Package Outline

Table 9. Dimension Description

Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.10	.038	.044
A1	0.025	0.10	.001	.004
A2	0.875	1.00	.035	.040
b	0.20	0.40	.008	.016
C	0.10	0.15	.004	.006
D	1.90	2.10	.076	.084
E	1.15	1.35	.046	.054
E1	2.00	2.20	.080	.088
e	0.65 BSC.		.026 BSC.	
e1	1.30 BSC.		.052 BSC.	
L	0.425 REF.		.017 BSC.	

Revision History

Revision	Date	Description of Change
0.0	2006/8/7	Original.
1.0	2008/1/17	Add High/Low gain control pin table and PCB layout design guide.

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