

NPN EPITAXIAL SILICON TRANSISTOR
FOR MICROWAVE LOW-NOISE AMPLIFICATION

The 2SC3604 is an NPN epitaxial transistor designed for low-noise amplification at 1.0 to 6.0 GHz. This transistor has low-noise and high-gain characteristics in a wide collector current region, and has a wide dynamic range.

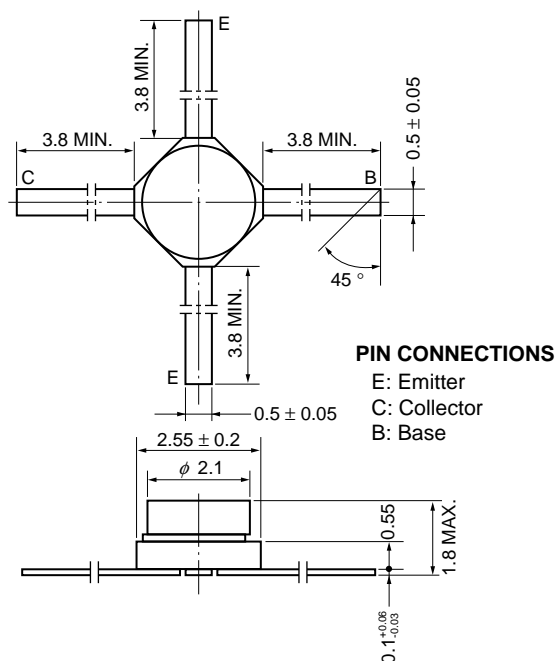
FEATURES

- Low noise : NF = 1.6 dB TYP. @ f = 2.0 GHz
- High power gain : $G_A = 12$ dB TYP. @ f = 2.0 GHz

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^\circ\text{C}$)

PARAMETER	SYMBOL	RATING	UNIT
Collector to Base Voltage	V_{CBO}	20	V
Collector to Emitter Voltage	V_{CEO}	10	V
Emitter to Base Voltage	V_{EBO}	1.5	V
Collector Current	I_C	65	mA
Total Power Dissipation	$P_T (T_C = 25\text{ }^\circ\text{C})$	580	mW
Junction Temperature	T_j	200	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

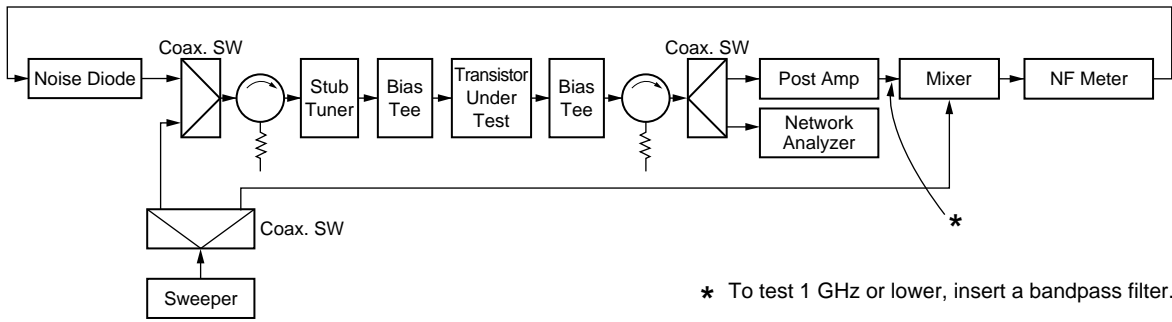
PACKAGE DIMENSIONS (in mm)



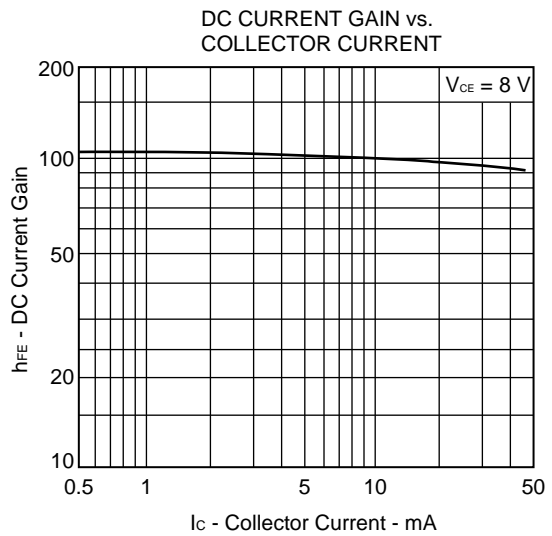
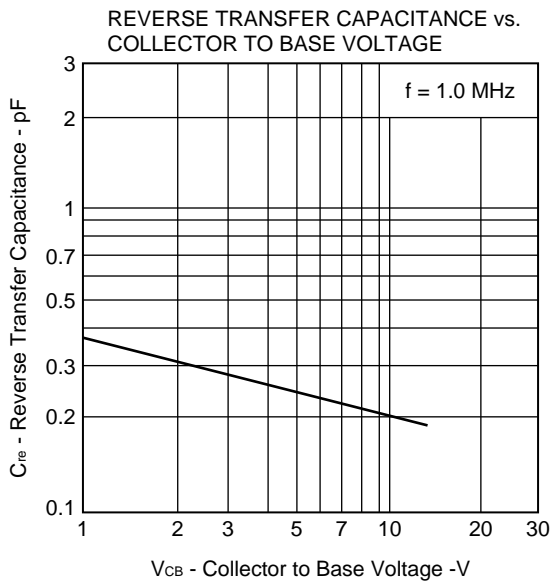
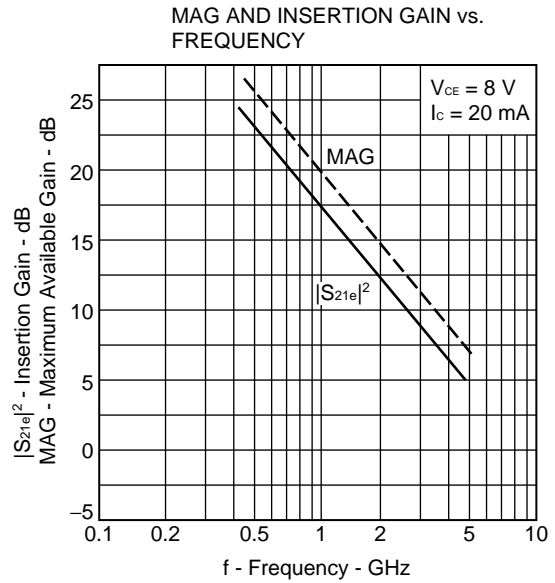
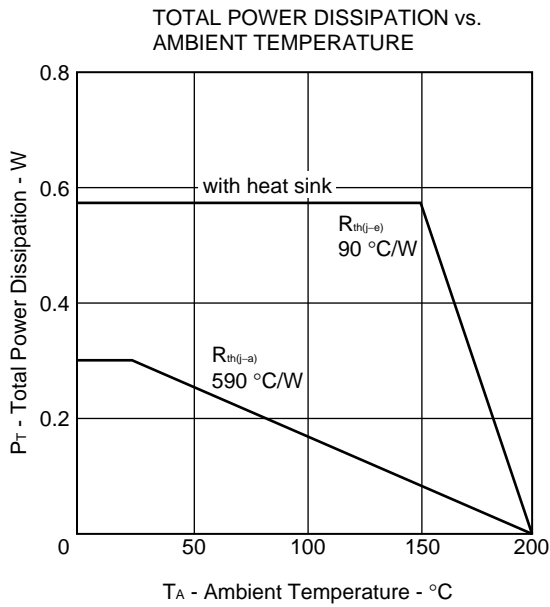
ELECTRICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$)

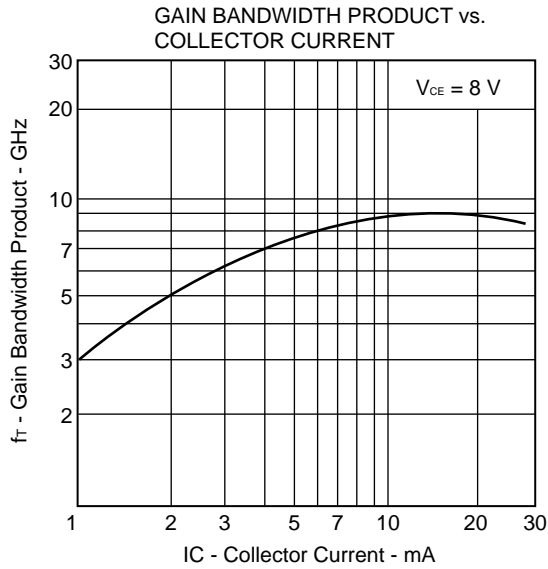
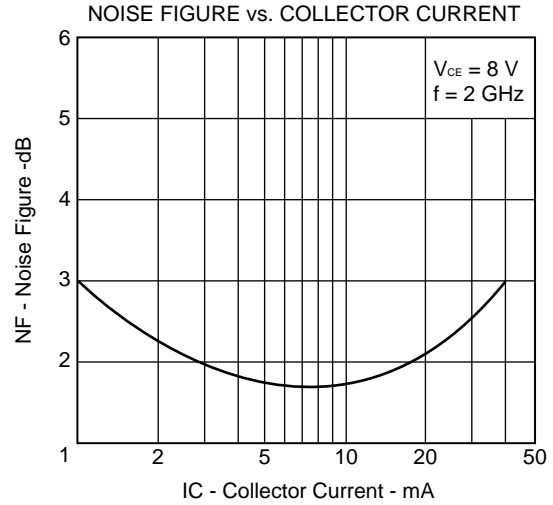
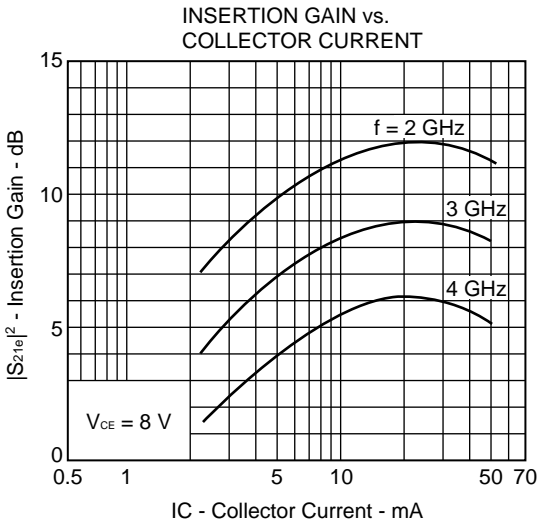
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	$V_{CB} = 10\text{ V}, I_E = 0$			1.0	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 1\text{ V}, I_C = 0$			1.0	μA
DC Current Gain	h_{FE}	$V_{CE} = 8\text{ V}, I_C = 20\text{ mA Pulse}$	50	100	250	
Gain Bandwidth Product	f_T	$V_{CE} = 8\text{ V}, I_C = 20\text{ mA}$		8		GHz
Reverse Transfer Capacitance	C_{re}	$V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$		0.2	0.7	pF
Noise Figure	NF^{Note}	$V_{CE} = 8\text{ V}, I_C = 7\text{ mA}, f = 2.0\text{ GHz}$		1.6	2.3	dB
Insertion Gain	$ S_{21e} ^2$	$V_{CE} = 8\text{ V}, I_C = 20\text{ mA}, f = 2.0\text{ GHz}$	9.0	11		dB
Maximum Available Gain	MAG	$V_{CE} = 8\text{ V}, I_C = 20\text{ mA}, f = 2.0\text{ GHz}$		13		dB
Power Gain	G_A	$V_{CE} = 8\text{ V}, I_C = 7\text{ mA}, f = 2.0\text{ GHz}$		12		dB

Note Test block diagram



TYPICAL CHARACTERISTICS (T_A = 25 °C)





S PARAMETER

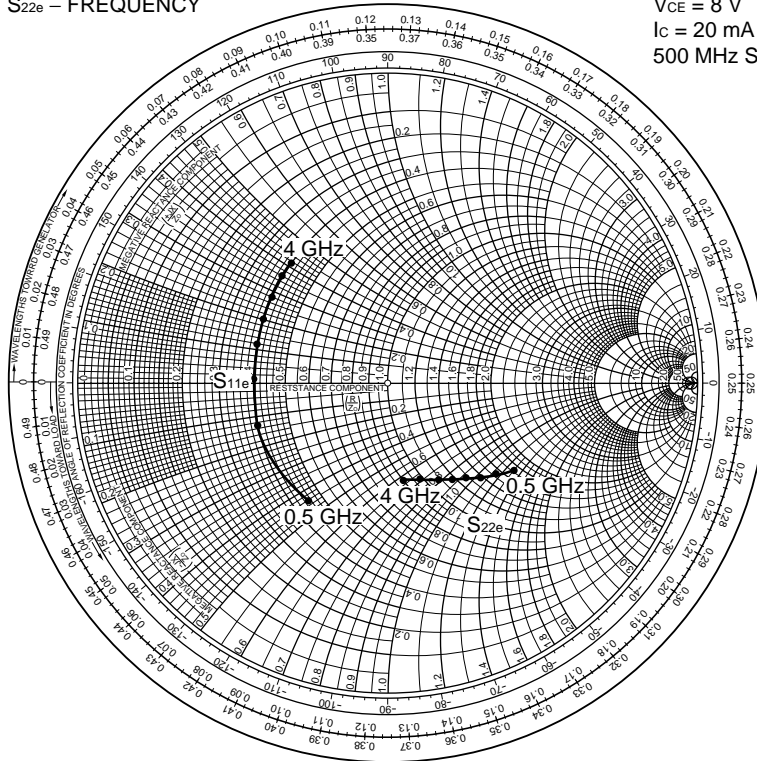
$V_{CE} = 6\text{ V}$, $I_C = 10\text{ mA}$, $Z_O = 50\ \Omega$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
500	.463	-125.3	13.822	106.8	.027	37.9	.516	-36.6
1000	.432	-162.7	7.901	86.2	.0424	48.2	.463	-40.7
1500	.416	178.7	5.250	71.1	.0606	53.1	.421	-46.2
2000	.439	165.0	3.949	59.7	.0758	52.0	.396	-50.9
2500	.451	153.6	3.151	51.7	.097	49.3	.372	-56.5
3000	.470	143.6	2.809	39.6	.111	45.1	.345	-63.7
3500	.482	135.2	2.337	28.6	.124	39.5	.320	-73.2
4000	.494	129.1	2.022	21.3	.132	35.5	.321	-82.0

S PARAMETER

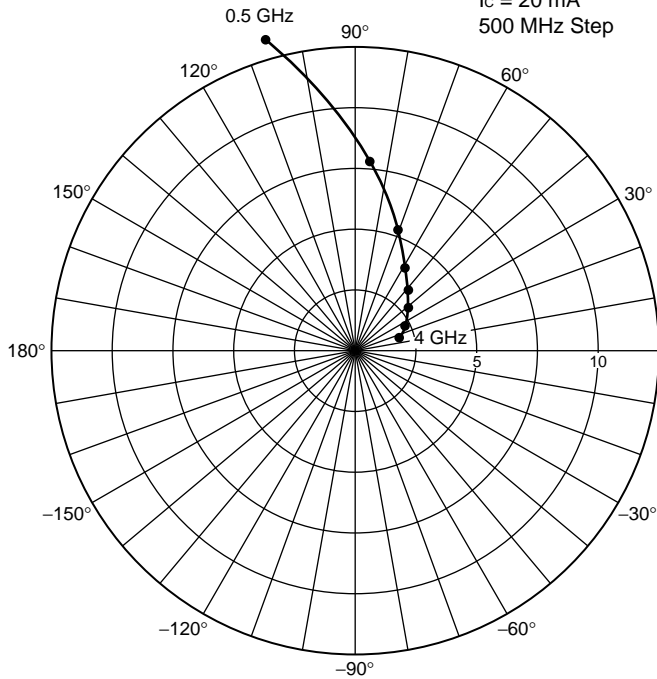
S_{11e}, S_{22e} – FREQUENCY

$V_{CE} = 8\text{ V}$
 $I_C = 20\text{ mA}$
 500 MHz Step



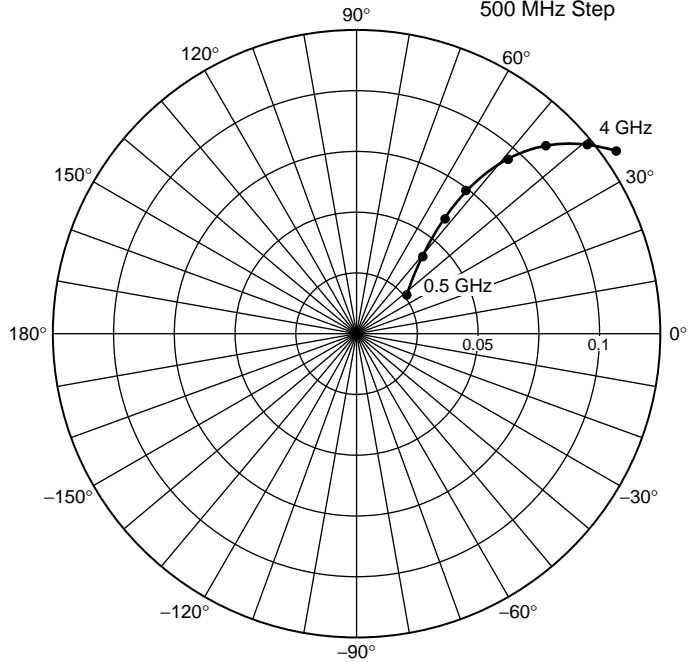
S_{21e} – FREQUENCY

$V_{CC} = 8\text{ V}$
 $I_C = 20\text{ mA}$
 500 MHz Step



S_{12e} – FREQUENCY

$V_{CE} = 8\text{ V}$
 $I_C = 20\text{ mA}$
 500 MHz Step

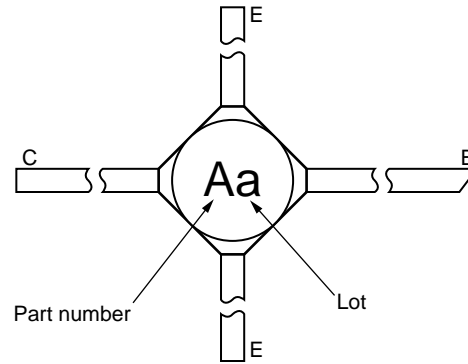


MARKING

Because the package of the micro X package transistor is too small to be marked, the following indication is employed.

Part Number

Part Number	Marking	Part Number	Marking
2SC2148	A	2SC3603	0
2SC2149	B	2SC3604	2
2SC2150	C	2SC3587	1
2SC2367	H		
2SC2585	K		
2SC1223	D		



Lot

Lot indication is colored as shown below.

The sequence black, brown, red, blue, and green, forms one cycle and this cycle is repeated.

Month \ Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	j Black	v	h	t	f	r	d	p	b
2	k	w	i	u	g	s	e	q	c
3	l	x	j	v	h	t	f	r	d
4	m	y	k	w	i	u	g	s	e
5	n	z	l	x	j	v	h	t	f
6	o	a Brown	m	y	k	w	i	u	g
7	p	b	n	z	l	x	j	v	h
8	q	c	o	a Red	m	y	k	w	i
9	r	d	p	b	n	z	l	x	j
10	s	e	q	c	o	a Blue	m	y	k
11	t	f	r	d	p	b	n	z	l
12	u	g	s	e	q	c	o	a Green	m

[MEMO]

[MEMO]

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Anti-radioactive design is not implemented in this product.