DATA SHEET

NEC

SILICON TRANSISTOR
2SC3604

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.

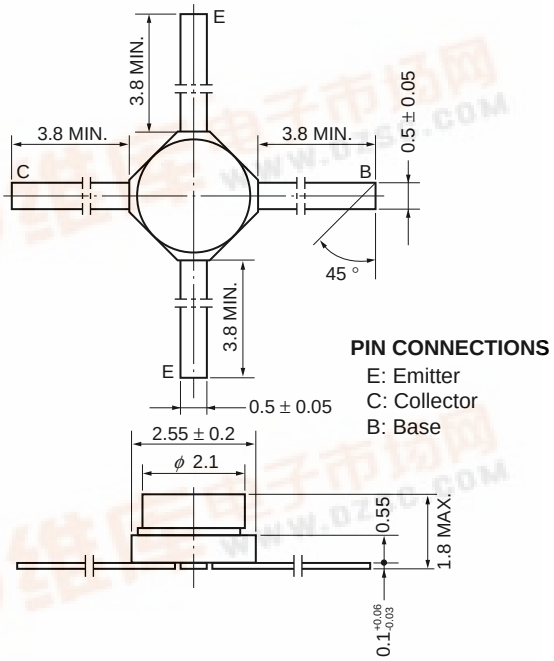
FEATURES

- 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 °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	$P_{T\ (T_C = 25\ °C)}$	580	mW
Junction Temperature	T_j	200	°C
Storage Temperature	T_{stg}	-65 to +150	°C

PACKAGE DIMENSIONS (in mm)

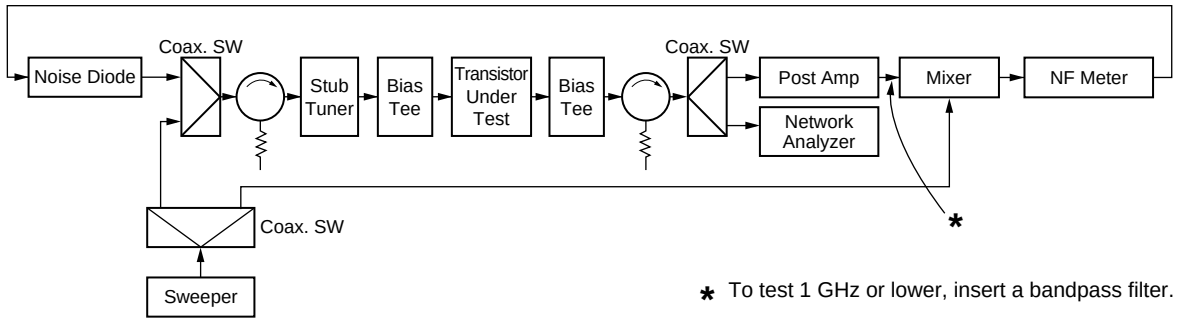


PIN CONNECTIONS
E: Emitter
C: Collector
B: Base

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

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

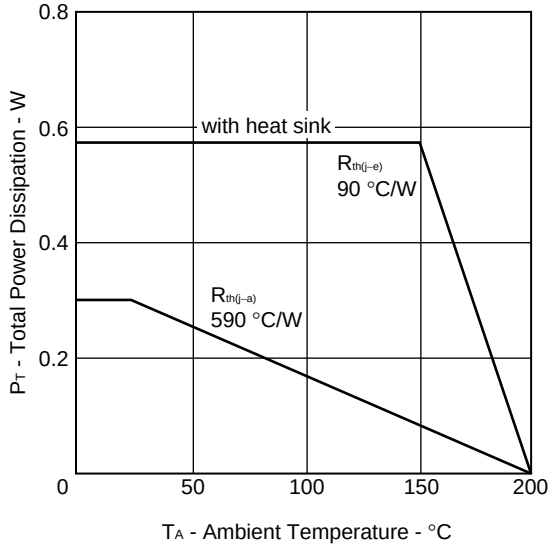
Note Test block diagram



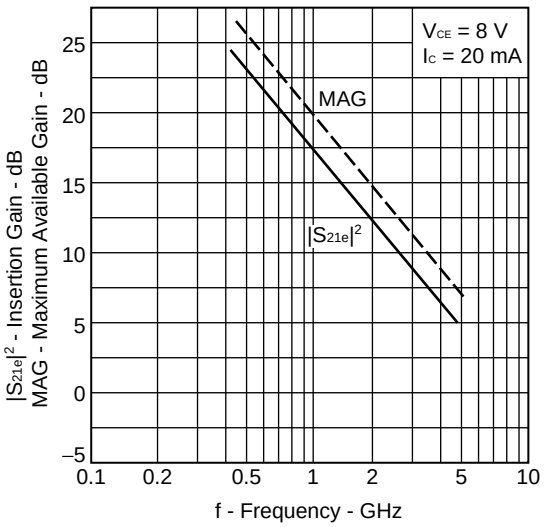
* To test 1 GHz or lower, insert a bandpass filter.

TYPICAL CHARACTERISTICS (T_A = 25 °C)

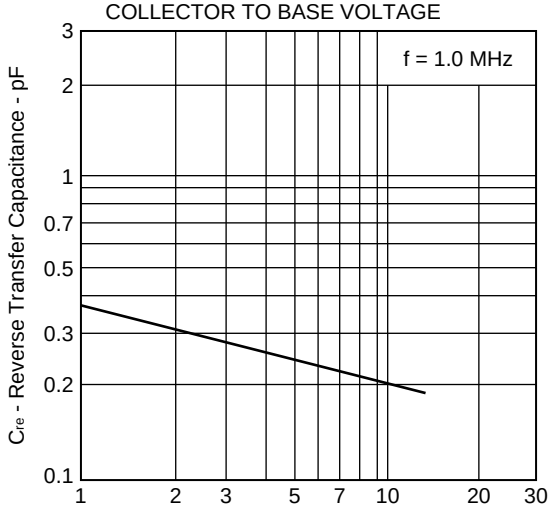
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



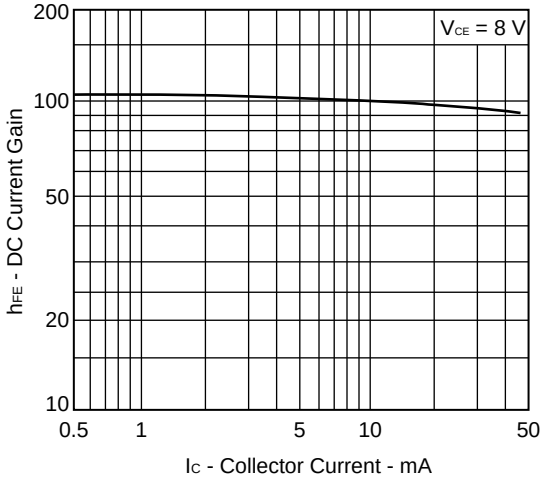
MAG AND INSERTION GAIN vs. FREQUENCY



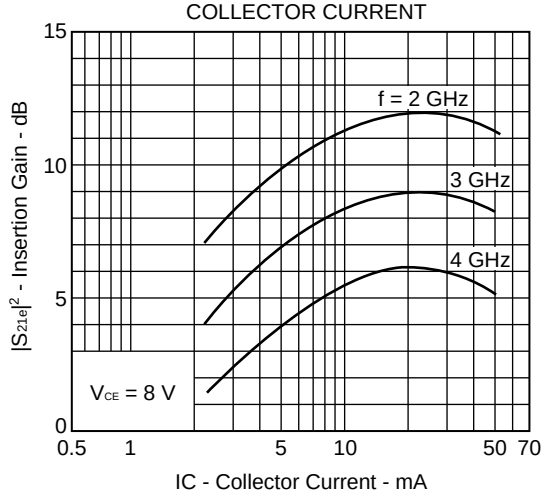
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



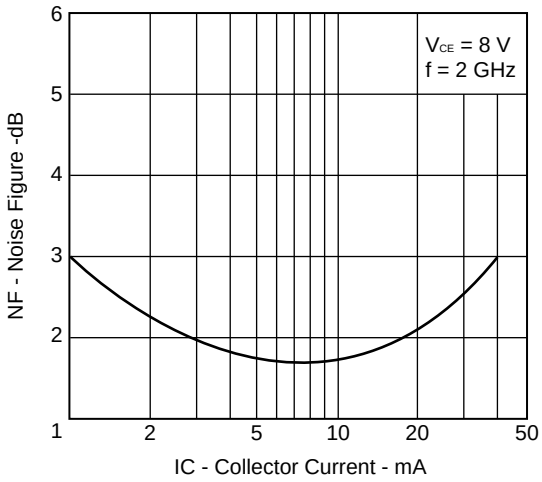
DC CURRENT GAIN vs. COLLECTOR CURRENT



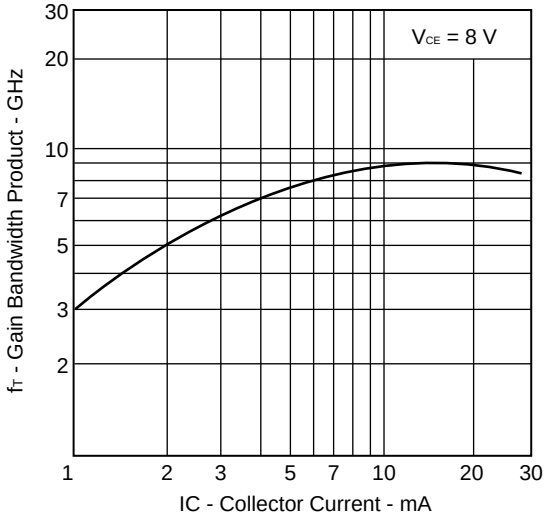
INSERTION GAIN vs.
COLLECTOR CURRENT



NOISE FIGURE vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT vs.
COLLECTOR CURRENT



S PARAMETER

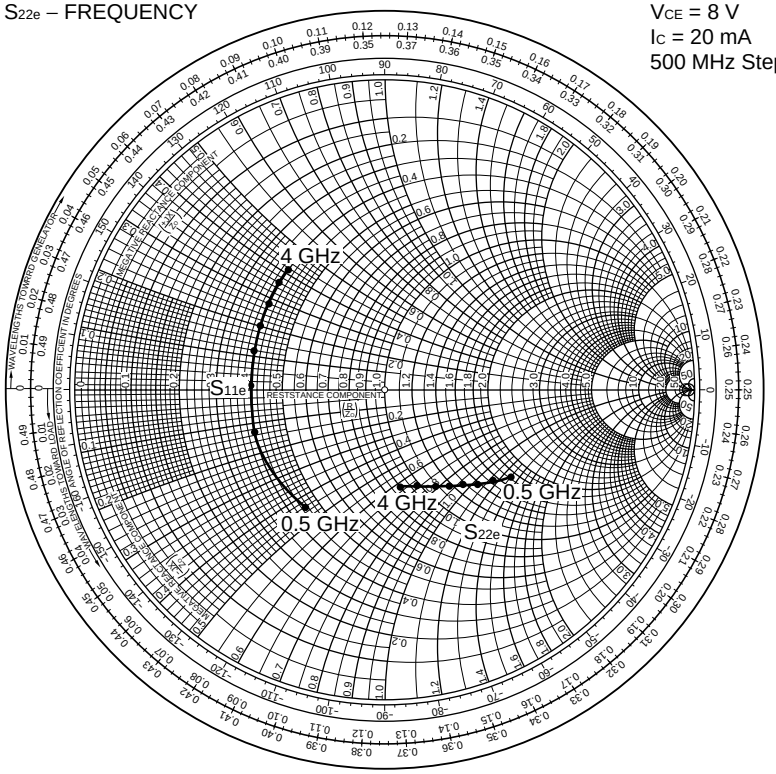
V_{CE} = 6 V, I_C = 10 mA, Z_O = 50 Ω

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

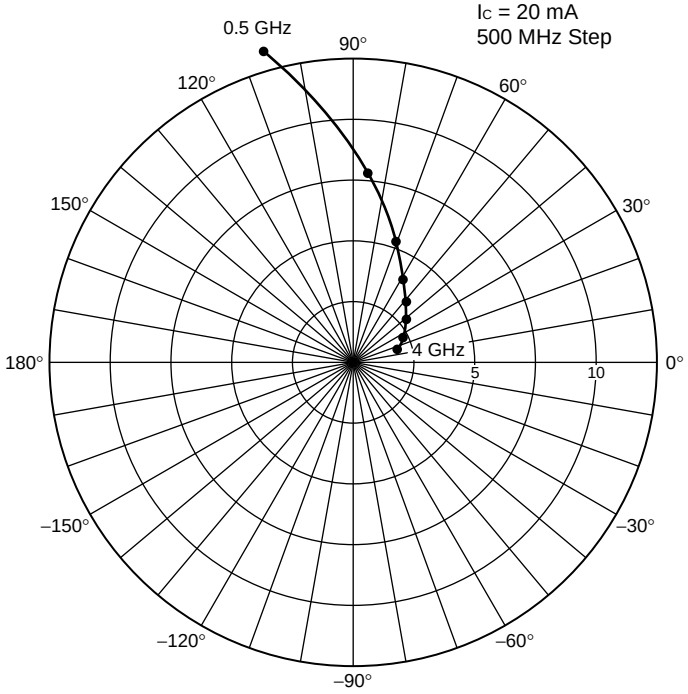
S_{11e}, S_{22e} – FREQUENCY

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



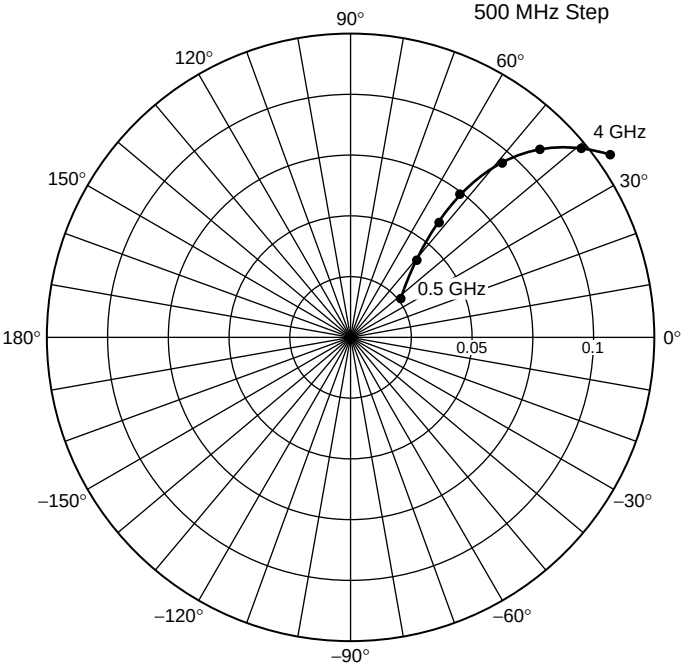
S_{21e} – FREQUENCY

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



S_{12e} – FREQUENCY

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

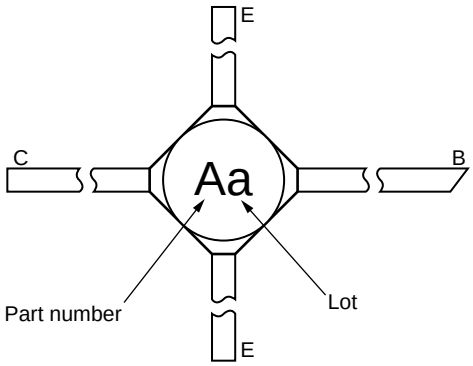


MARKING

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]

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