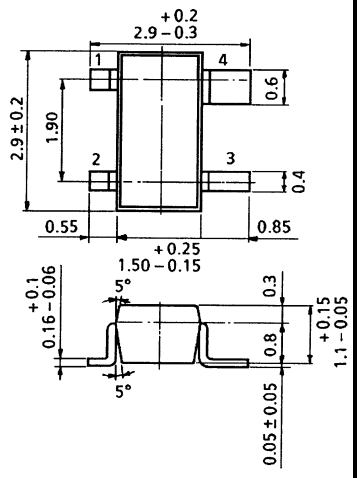
TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5092

VHF~UHF Band Low Noise Amplifier Applications

- Low noise figure, high gain.
- NF = 1.8dB, $|S_{21e}|^2$ = 9.5dB (f = 2 GHz)

Unit: mm



1, 3. EMITTER
2. BASE
4. COLLECTOR

SMQ

JEDEC	—
JEITA	—
TOSHIBA	2-3J1C

Weight: 0.012 g (typ.)

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	20	V
Collector-emitter voltage	V_{CEO}	10	V
Emitter-base voltage	V_{EBO}	1.5	V
Base current	I_B	20	mA
Collector current	I_C	40	mA
Collector power dissipation	P_C	150	mW
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	−55~125	°C

Microwave Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	f_T	V_{CE} = 8 V, I_C = 20 mA	7	10	—	GHz
Insertion gain	$\|S_{21e}\|^2$ (1)	V_{CE} = 8 V, I_C = 20 mA, f = 1 GHz	12	15	—	dB
	$\|S_{21e}\|^2$ (2)	V_{CE} = 8 V, I_C = 20 mA, f = 2 GHz	6.5	9.5	—	
Noise figure	NF (1)	V_{CE} = 8 V, I_C = 5 mA, f = 1 GHz	—	1.4	2.5	dB
	NF (2)	V_{CE} = 8 V, I_C = 5 mA, f = 2 GHz	—	1.8	3	

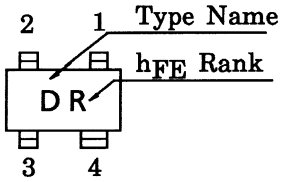
Electrical Characteristics (Ta = 25°C)

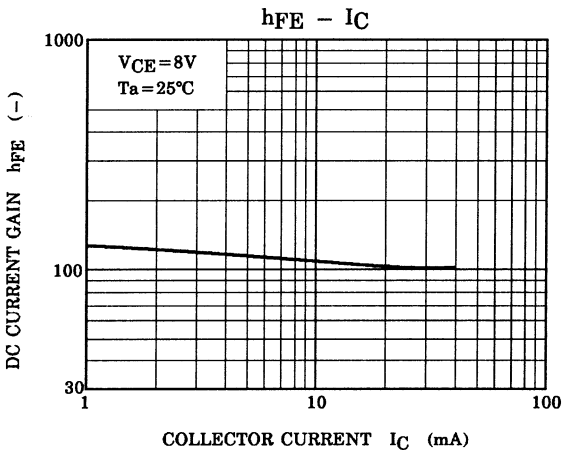
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 10 V, I_E = 0	—	—	1	μA
Emitter cut-off current	I_{EBO}	V_{EB} = 1 V, I_C = 0	—	—	1	μA
DC current gain	h_{FE} (Note 1)	V_{CE} = 8 V, I_C = 20 mA	50	—	160	
Output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz (Note 2)	—	0.7	1.1	pF
Reverse transfer capacitance	C_{re}		—	0.45	0.95	pF

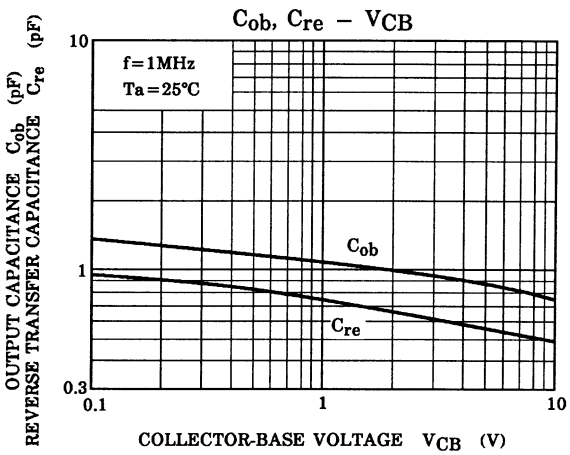
Note 1: h_{FE} classification R: 50~100, O: 80~160

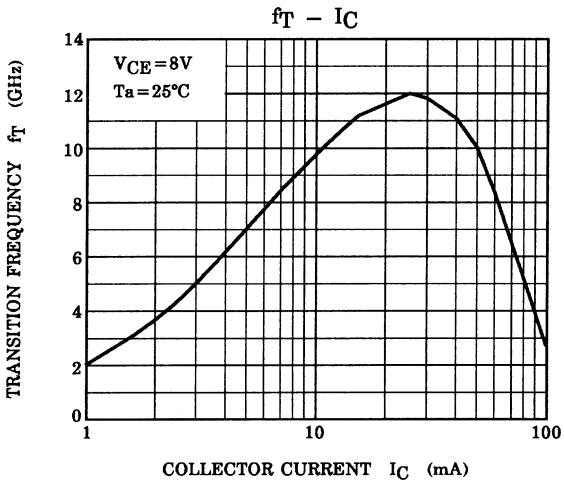
Note 2: C_{re} is measured by 3 terminal method with capacitance bridge.

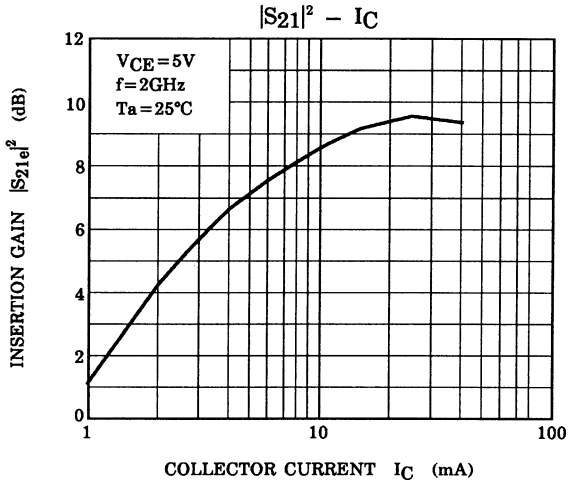
Marking

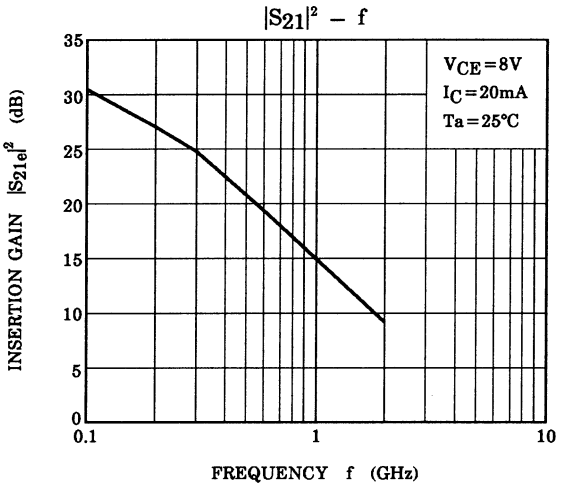


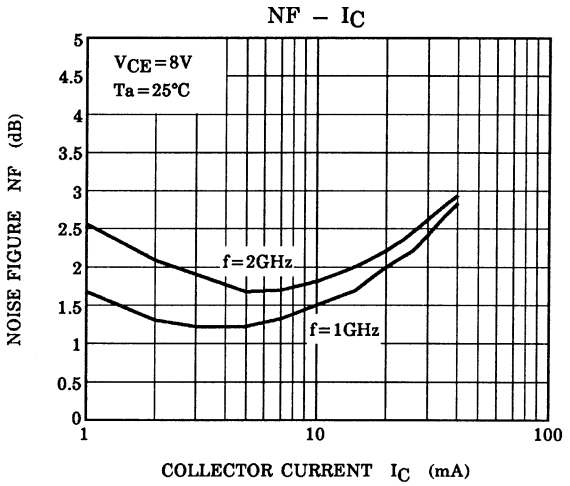

h_{FE} – I_C
V_{CE}=8V
Ta=25°C
DC CURRENT GAIN h_{FE} (–)
1000
100
30
1
10
100
COLLECTOR CURRENT I_C (mA)

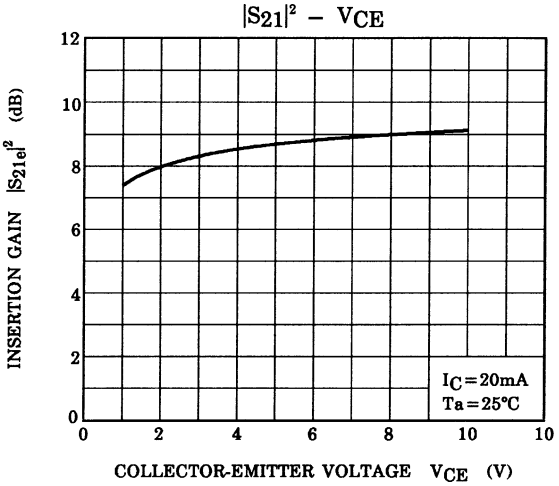

C_{ob}, C_{re} – V_{CB}
f=1MHz
Ta=25°C
OUTPUT CAPACITANCE C_{ob} (pF)
REVERSE TRANSFER CAPACITANCE C_{re} (pF)
10
1
0.3
C_{ob}
C_{re}
0.1
1
10
COLLECTOR-BASE VOLTAGE V_{CB} (V)

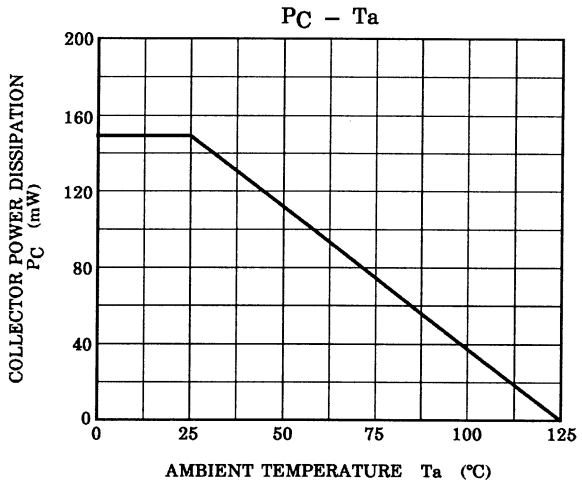

f_T – I_C
V_{CE}=8V
Ta=25°C
TRANSITION FREQUENCY f_T (GHz)
14
12
10
8
6
4
2
0
1
10
100
COLLECTOR CURRENT I_C (mA)


$|S_{21}|^2$ – I_C
V_{CE}=5V
f=2GHz
Ta=25°C
INSERTION GAIN $|S_{21e}|^2$ (dB)
12
10
8
6
4
2
0
1
10
100
COLLECTOR CURRENT I_C (mA)


$|S_{21}|^2$ – f
V_{CE}=8V
I_C=20mA
Ta=25°C
INSERTION GAIN $|S_{21e}|^2$ (dB)
35
30
25
20
15
10
5
0
0.1
1
10
FREQUENCY f (GHz)


NF – I_C
V_{CE}=8V
Ta=25°C
NOISE FIGURE NF (dB)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
f=2GHz
f=1GHz
1
10
100
COLLECTOR CURRENT I_C (mA)





S-Parameter Z_O = 50 Ω, Ta = 25°C

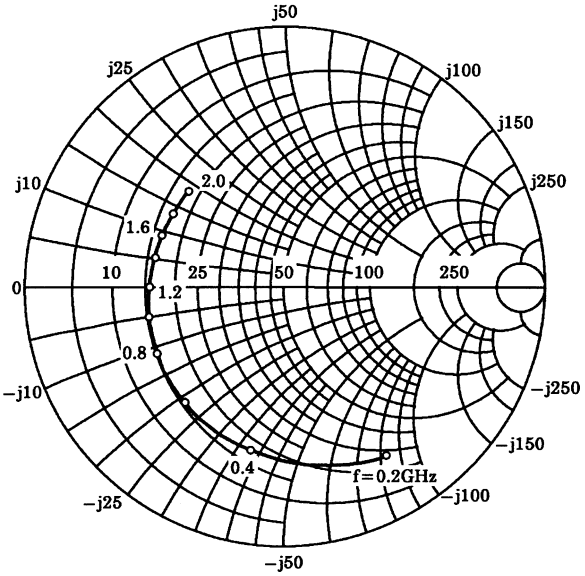
V_{CE} = 8 V, I_C = 5 mA

Frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.767	–58.9	12.888	143.5	0.049	62.8	0.856	–34.5
400	0.655	–102.2	9.480	119.3	0.073	48.7	0.663	–57.5
600	0.605	–130.0	7.087	104.6	0.086	43.1	0.535	–72.7
800	0.567	–150.4	5.577	93.9	0.093	40.7	0.456	–84.3
1000	0.547	–166.4	4.548	86.0	0.098	41.1	0.407	–93.8
1200	0.533	–179.7	3.798	79.3	0.103	42.5	0.373	–102.4
1400	0.528	169.1	3.268	76.9	0.109	44.1	0.346	–110.3
1600	0.519	158.4	2.856	69.3	0.116	46.6	0.328	–117.4
1800	0.520	148.3	2.551	65.1	0.124	48.9	0.314	–123.0
2000	0.524	138.7	2.290	61.1	0.133	51.1	0.303	–128.3

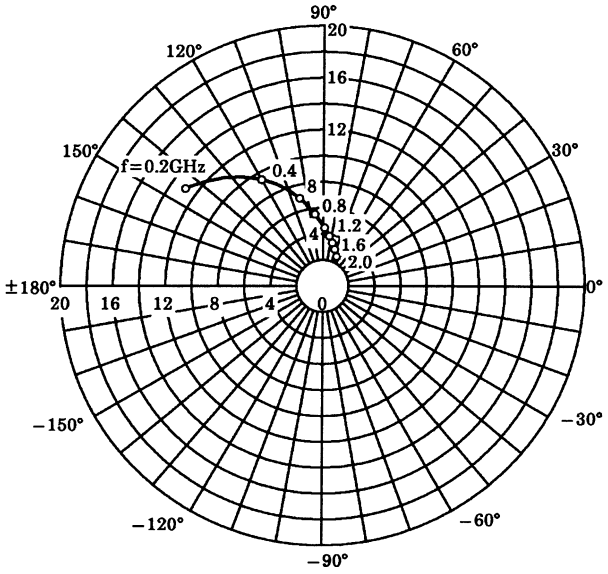
V_{CE} = 8 V, I_C = 20 mA

Frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.540	–106.8	23.009	123.0	0.033	56.9	0.605	–57.8
400	0.521	–147.5	13.445	102.7	0.045	54.9	0.392	–81.2
600	0.521	–167.1	9.277	92.8	0.057	57.9	0.309	–95.5
800	0.525	–178.9	7.029	85.7	0.069	60.0	0.271	–107.3
1000	0.526	–168.8	5.651	80.0	0.082	62.5	0.250	–117.9
1200	0.529	–158.7	4.688	75.6	0.094	63.4	0.236	–127.6
1400	0.531	–148.5	4.011	71.6	0.106	64.5	0.225	–136.2
1600	0.536	–140.4	3.531	68.1	0.119	65.1	0.214	–143.8
1800	0.539	–131.7	3.159	64.7	0.133	65.5	0.201	–149.8
2000	0.540	–122.8	2.842	61.8	0.147	65.7	0.190	–154.8

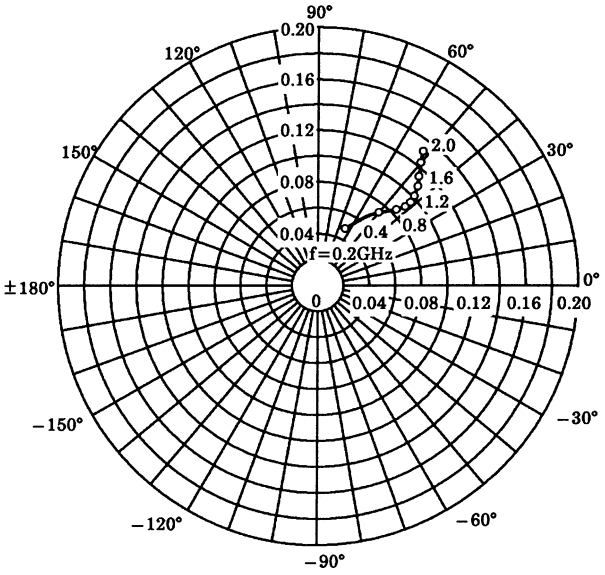
S_{11e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C
(Unit : Ω)



S_{21e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C



S_{12e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C



S_{22e}
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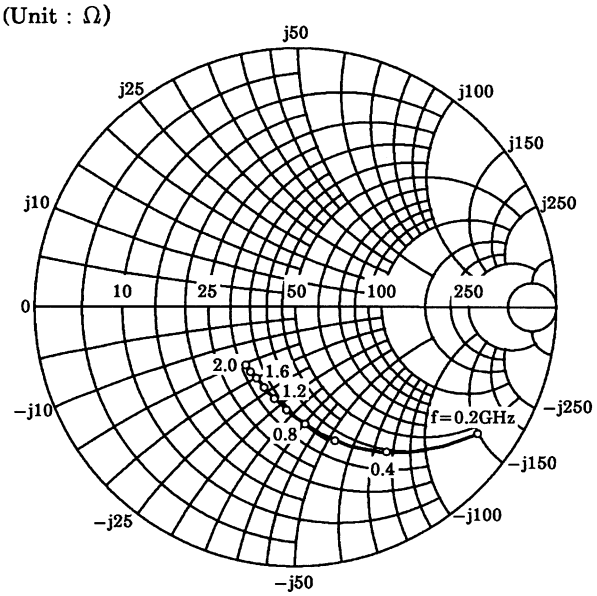
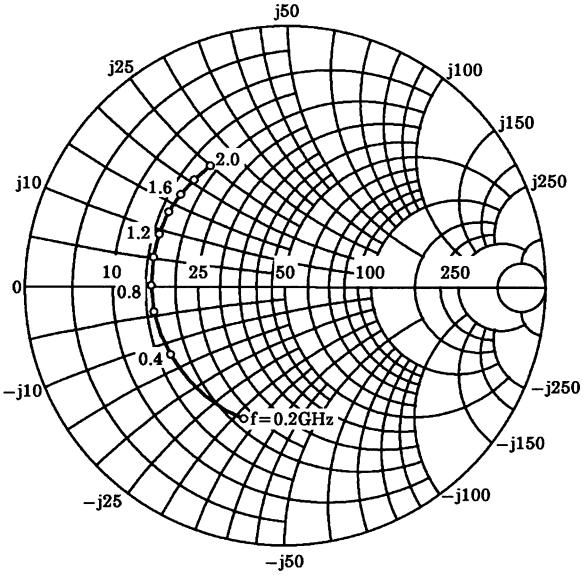
I_C = 5mA
Ta = 25°C
(Unit : Ω)



S_{11e}
V_{CE} = 8V
I_C = 20mA
Ta = 25°C
(Unit : Ω)



S_{21e}
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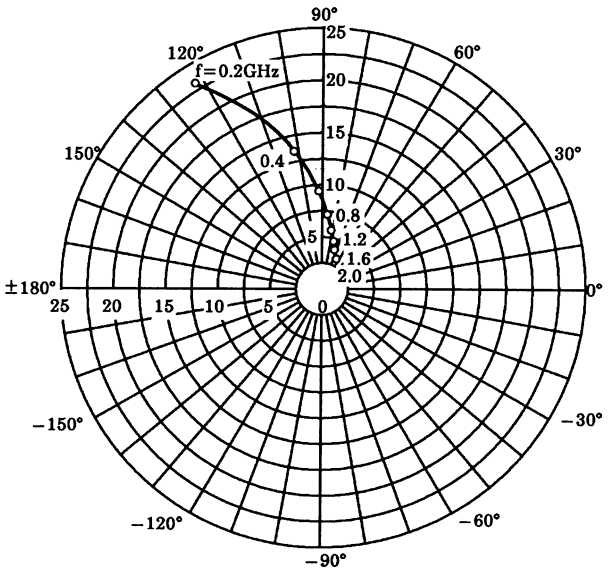
I_C = 20mA
Ta = 25°C



S_{12e}
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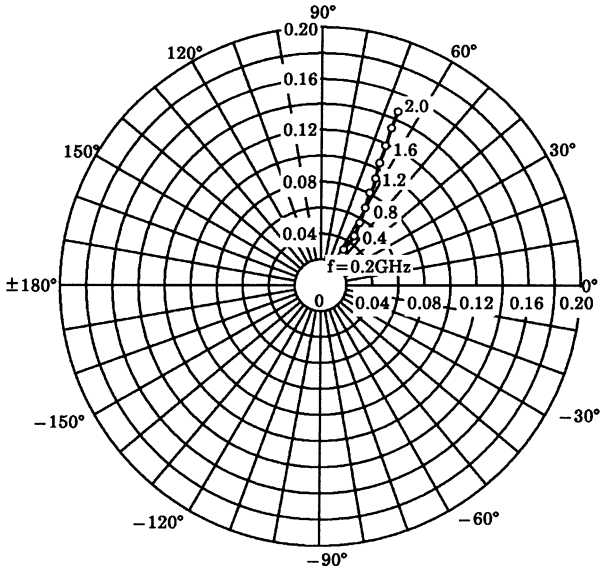

S_{22e}
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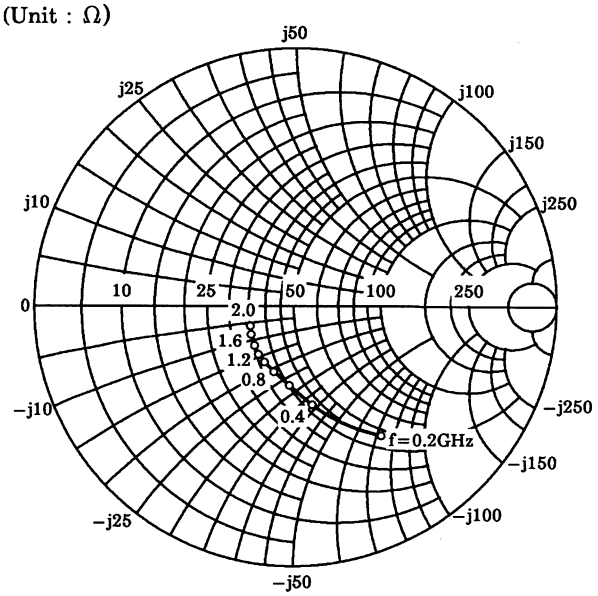
Ta = 25°C
(Unit : Ω)



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