

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5096

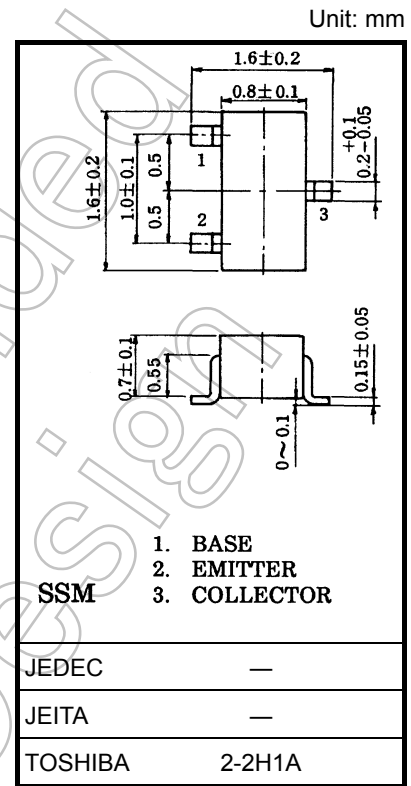
## VHF~UHF Band Low Noise Amplifier Applications

- Low noise figure, high gain.
- $NF = 1.8\text{dB}$ ,  $|S_{21e}|^2 = 7.5\text{dB}$  ( $f = 2\text{ GHz}$ )

### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

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	$I_B$	7	mA
Collector current	$I_C$	15	mA
Collector power dissipation	$P_C$	100	mW
Junction temperature	$T_j$	125	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 125	$^\circ\text{C}$

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.  
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).



Weight: 2.4 mg (typ.)

### Microwave Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 6\text{ V}$ , $I_C = 7\text{ mA}$	7	10	—	GHz
Insertion gain	$ S_{21e} ^2$ (1)	$V_{CE} = 6\text{ V}$ , $I_C = 7\text{ mA}$ , $f = 1\text{ GHz}$	—	13	—	dB
	$ S_{21e} ^2$ (2)	$V_{CE} = 6\text{ V}$ , $I_C = 7\text{ mA}$ , $f = 2\text{ GHz}$	4.5	7.5	—	
Noise figure	NF (1)	$V_{CE} = 6\text{ V}$ , $I_C = 3\text{ mA}$ , $f = 1\text{ GHz}$	—	1.4	—	dB
	NF (2)	$V_{CE} = 6\text{ V}$ , $I_C = 3\text{ mA}$ , $f = 2\text{ GHz}$	—	1.8	3.0	

### Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

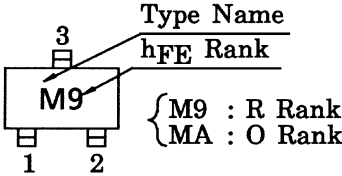
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 10\text{ V}$ , $I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{ V}$ , $I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$ (Note 1)	$V_{CE} = 6\text{ V}$ , $I_C = 7\text{ mA}$	50	—	160	
Output capacitance	$C_{ob}$	$V_{CB} = 10\text{ V}$ , $I_E = 0$ , $f = 1\text{ MHz}$ (Note 2)	—	0.5	—	pF
Reverse transfer capacitance	$C_{re}$		—	0.4	0.85	pF

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

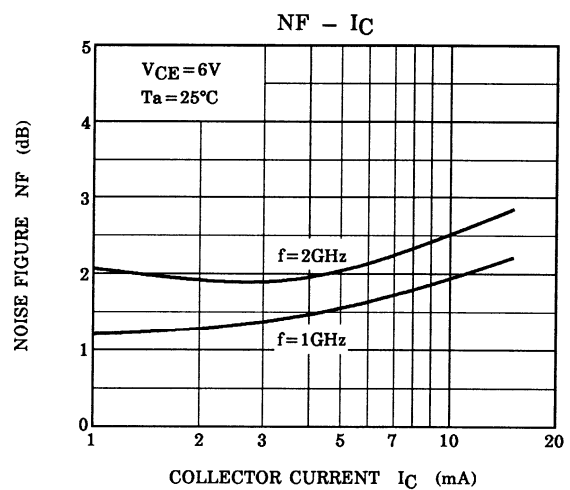
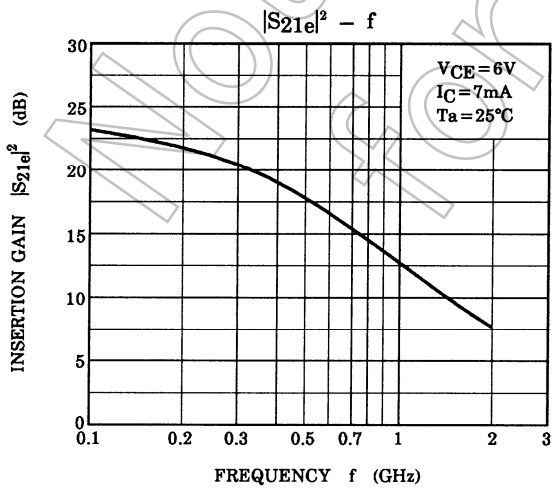
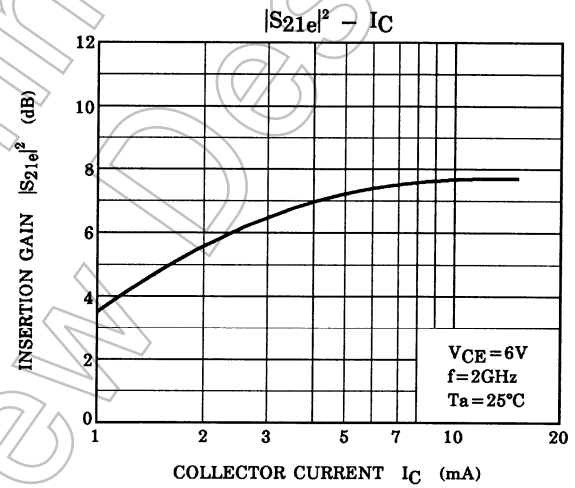
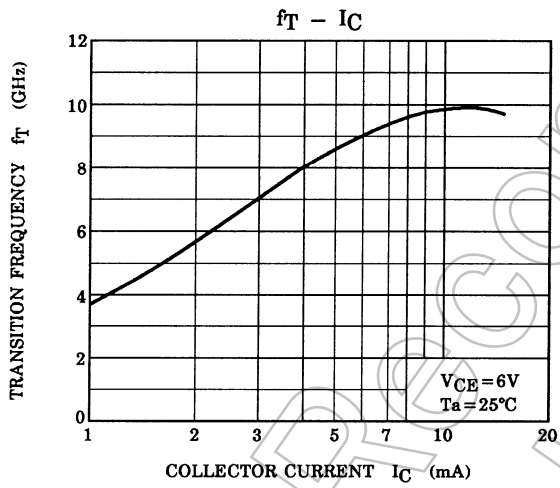
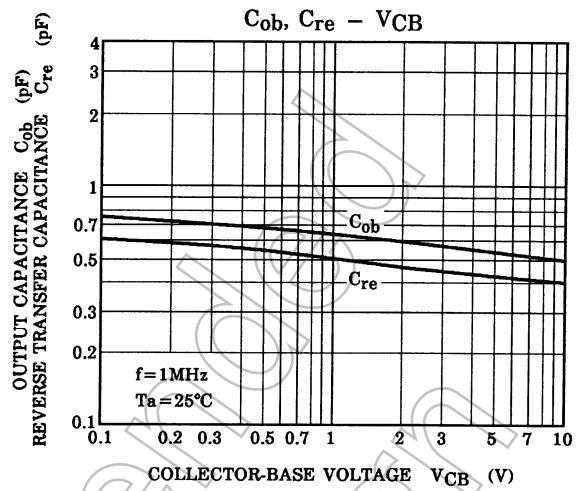
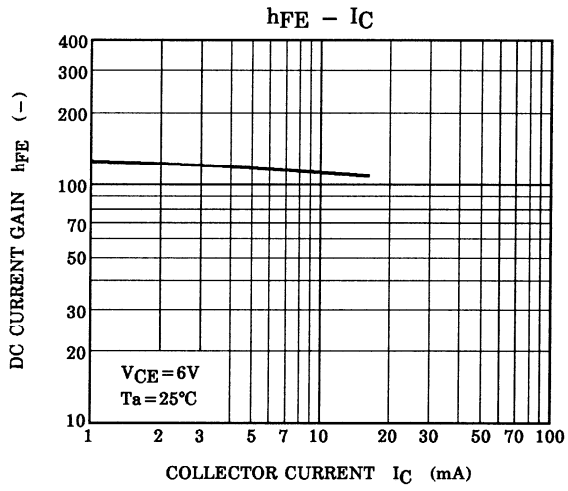
Note 2:  $C_{re}$  is measured by 3 terminal method with capacitance bridge.

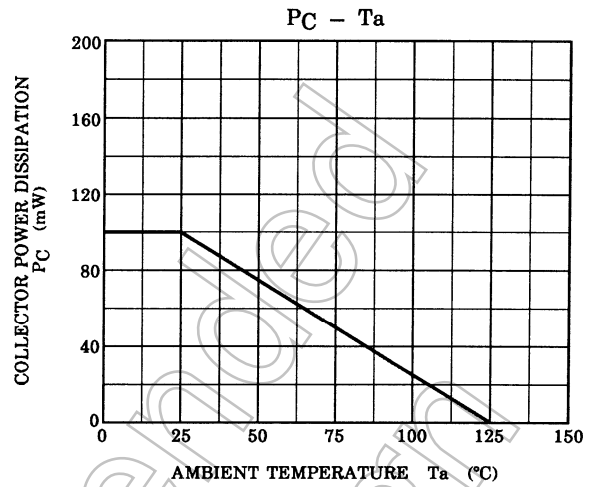
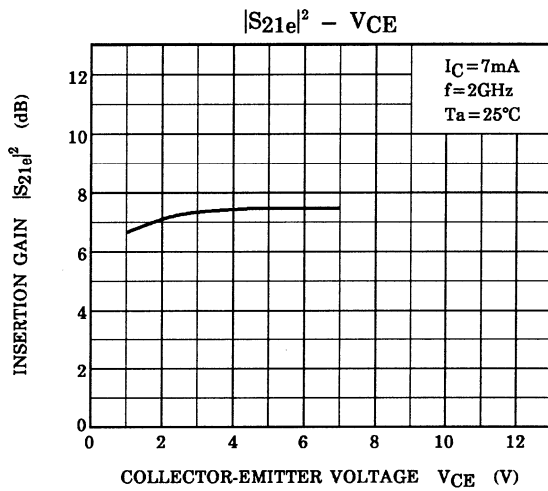
Start of commercial production  
1993-10

**Marking**



Not Recommended  
for New Design





**S-Parameter  $Z_0 = 50 \Omega, T_a = 25^\circ\text{C}$**

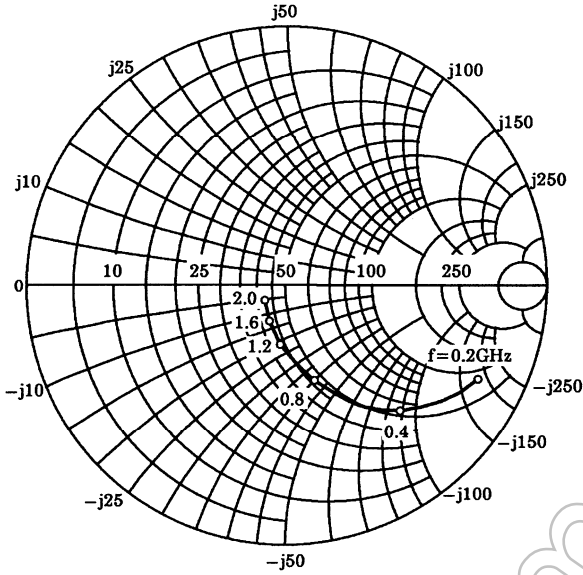
**$V_{CE} = 6 \text{ V}, I_C = 3 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.835	-26.1	7.069	150.4	0.046	71.0	0.899	-19.3
400	0.665	-46.5	5.948	130.4	0.076	60.5	0.745	-30.3
600	0.501	-62.7	5.021	115.2	0.095	55.7	0.630	-35.9
800	0.386	-74.3	4.173	104.3	0.111	53.7	0.552	-38.5
1000	0.297	-83.7	3.592	95.6	0.124	53.2	0.500	-39.9
1200	0.226	-92.7	3.140	88.5	0.137	53.6	0.465	-41.1
1400	0.175	-101.9	2.808	82.3	0.152	54.1	0.442	-42.2
1600	0.130	-113.4	2.514	76.6	0.165	54.2	0.421	-43.8
1800	0.103	-128.0	2.293	71.7	0.179	53.9	0.405	-45.7
2000	0.081	-147.4	2.114	67.3	0.193	54.8	0.388	-47.4

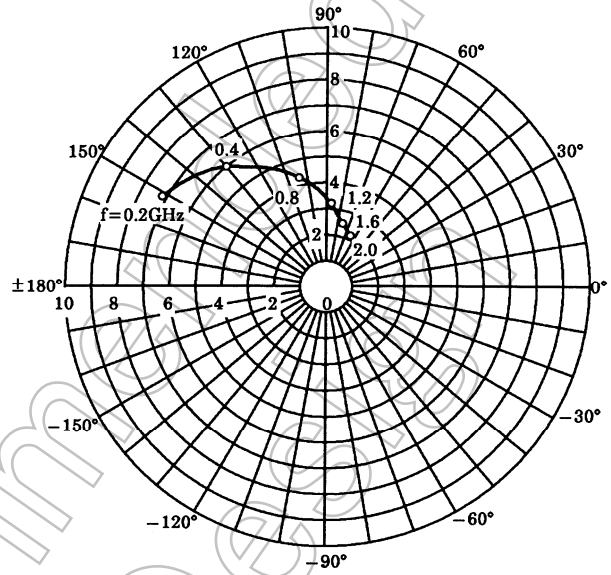
**$V_{CE} = 6 \text{ V}, I_C = 7 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.668	-40.0	12.306	138.9	0.040	67.3	0.786	-27.0
400	0.427	-64.4	8.852	116.1	0.061	61.6	0.579	-35.0
600	0.280	-79.5	6.591	102.9	0.078	61.8	0.476	-35.9
800	0.193	-89.7	5.191	94.3	0.096	62.5	0.420	-35.0
1000	0.134	-99.3	4.288	87.8	0.112	63.2	0.390	-34.2
1200	0.088	-112.3	3.661	81.9	0.130	63.8	0.374	-34.0
1400	0.056	-129.8	3.232	76.9	0.150	63.4	0.366	-34.8
1600	0.035	-169.0	2.857	72.1	0.168	62.5	0.356	-36.6
1800	0.040	157.0	2.574	68.1	0.185	61.4	0.347	-39.0
2000	0.054	131.5	2.363	64.3	0.203	61.3	0.338	-40.2

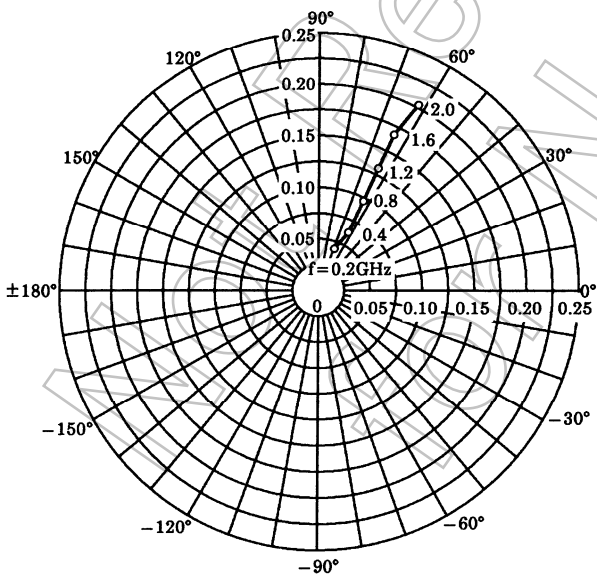
**S11e**  
 VCE=6V  
 IC=3mA  
 Ta=25°C  
 (UNIT : Ω)



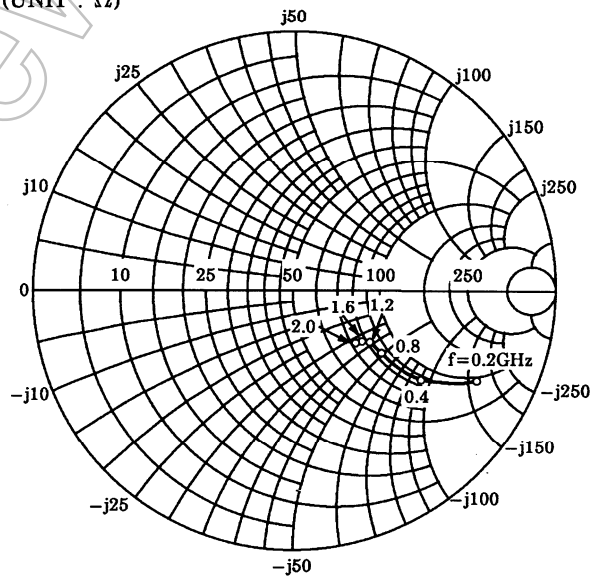
**S21e**  
 VCE=6V  
 IC=3mA  
 Ta=25°C



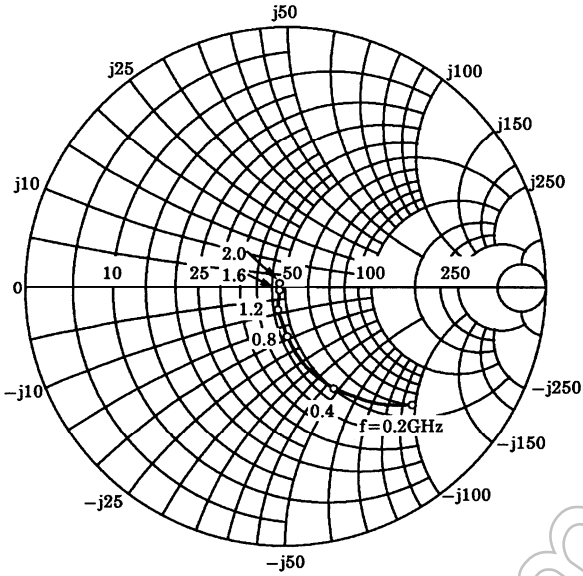
**S12e**  
 VCE=6V  
 IC=7mA  
 Ta=25°C



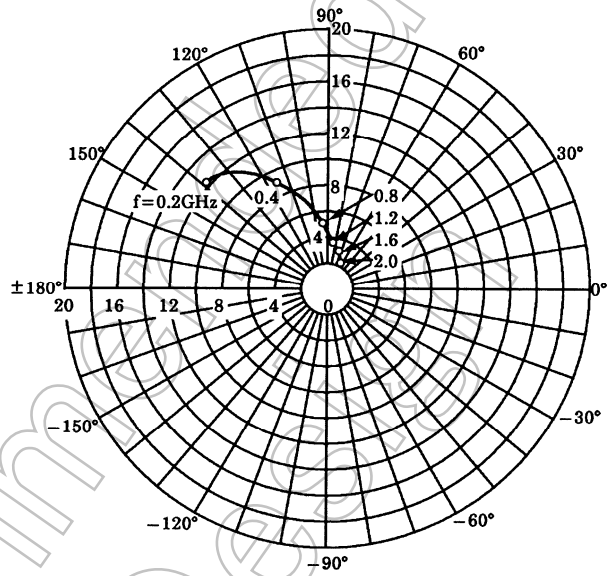
**S22e**  
 VCE=6V  
 IC=7mA  
 Ta=25°C  
 (UNIT : Ω)



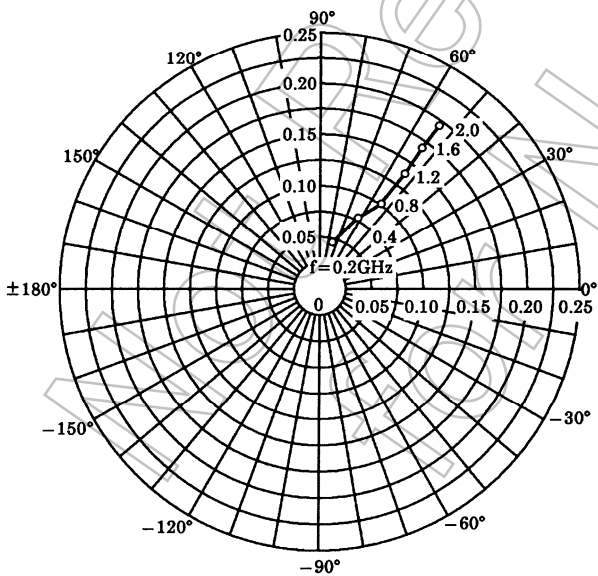
**S11e**  
 $V_{CE} = 6V$   
 $I_C = 7mA$   
 $T_a = 25^\circ C$   
 (UNIT :  $\Omega$ )



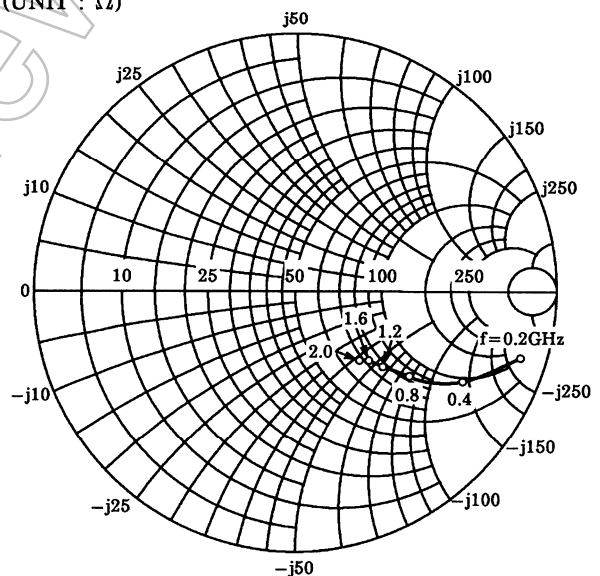
**S21e**  
 $V_{CE} = 6V$   
 $I_C = 7mA$   
 $T_a = 25^\circ C$



**S12e**  
 $V_{CE} = 6V$   
 $I_C = 3mA$   
 $T_a = 25^\circ C$



**S22e**  
 $V_{CE} = 6V$   
 $I_C = 3mA$   
 $T_a = 25^\circ C$   
 (UNIT :  $\Omega$ )



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