

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5089

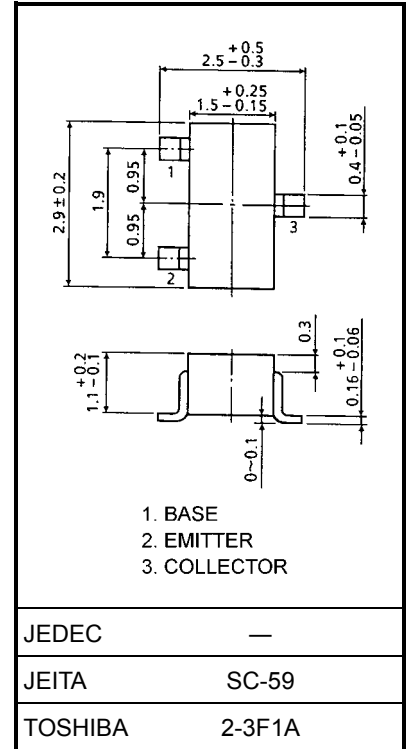
## VHF~UHF Band Low Noise Amplifier Applications

Unit: mm

- Low noise figure, high gain.
- $NF = 1.1\text{dB}$ ,  $|S_{21e}|^2 = 13\text{dB}$  ( $f = 1\text{GHz}$ )

### 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	$I_B$	20	mA
Collector current	$I_C$	40	mA
Collector power dissipation	$P_C$	150	mW
Junction temperature	$T_j$	125	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~125	$^\circ\text{C}$



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

Weight: 0.012 g (typ.)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 8\text{V}$ , $I_C = 20\text{mA}$	7	10	—	GHz
Insertion gain	$ S_{21e} ^2 (1)$	$V_{CE} = 8\text{V}$ , $I_C = 20\text{mA}$ , $f = 1\text{GHz}$	10	13	—	dB
	$ S_{21e} ^2 (2)$	$V_{CE} = 8\text{V}$ , $I_C = 20\text{mA}$ , $f = 2\text{GHz}$	—	7	—	
Noise figure	NF (1)	$V_{CE} = 8\text{V}$ , $I_C = 5\text{mA}$ , $f = 1\text{GHz}$	—	1.1	2.5	dB
	NF (2)	$V_{CE} = 8\text{V}$ , $I_C = 5\text{mA}$ , $f = 2\text{GHz}$	—	1.7	—	

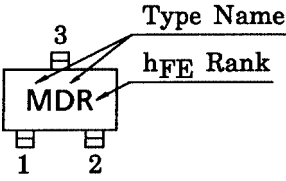
### Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

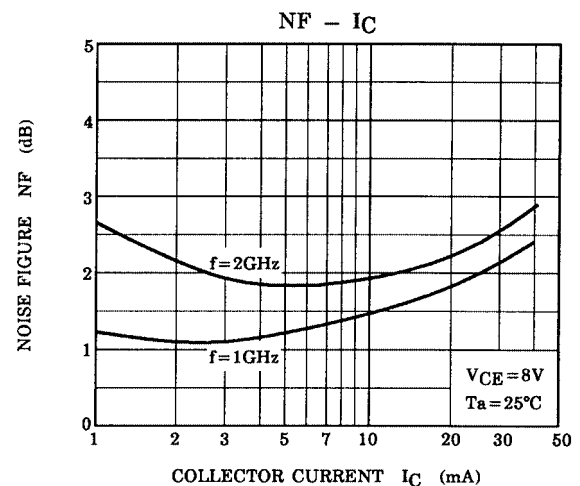
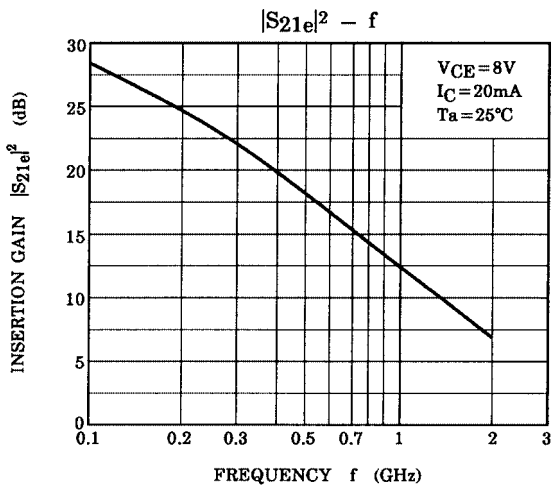
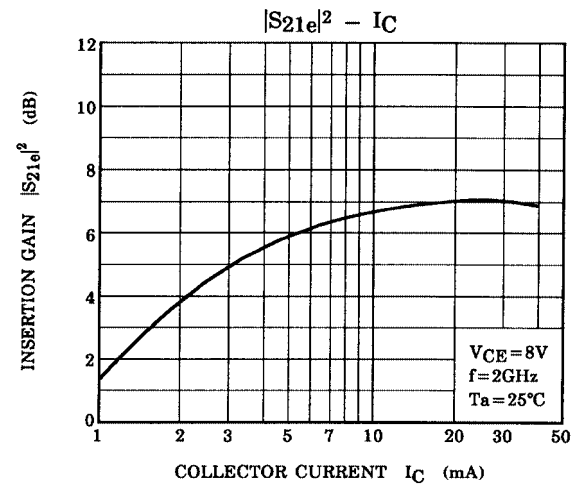
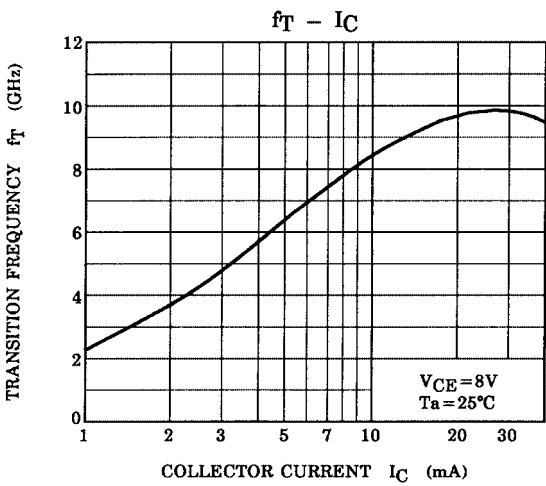
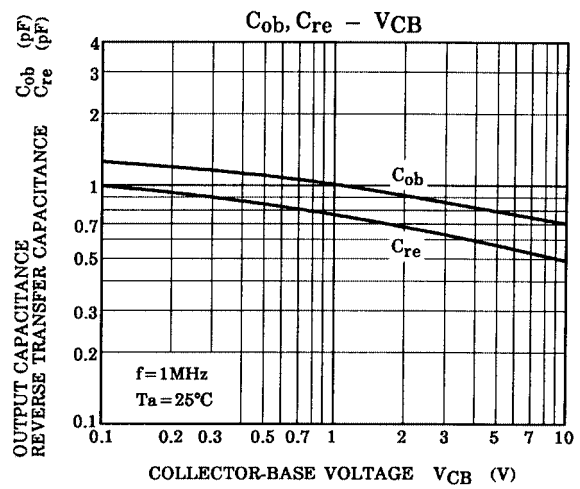
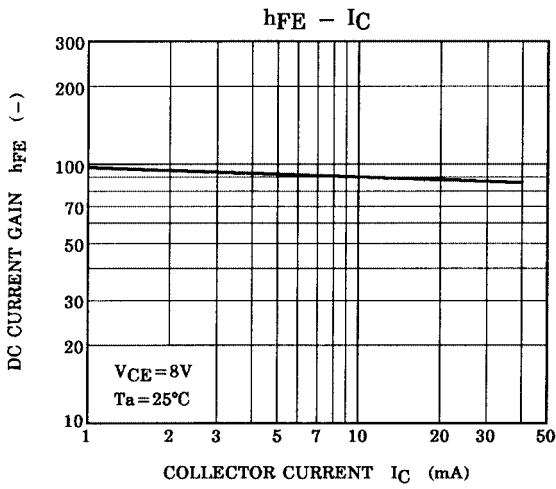
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 10\text{V}$ , $I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{V}$ , $I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$ (Note 1)	$V_{CE} = 8\text{V}$ , $I_C = 20\text{mA}$	50	—	160	
Output capacitance	$C_{ob}$	$V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$ (Note 2)	—	0.7	—	pF
Reverse transfer capacitance	$C_{re}$		—	0.5	0.95	pF

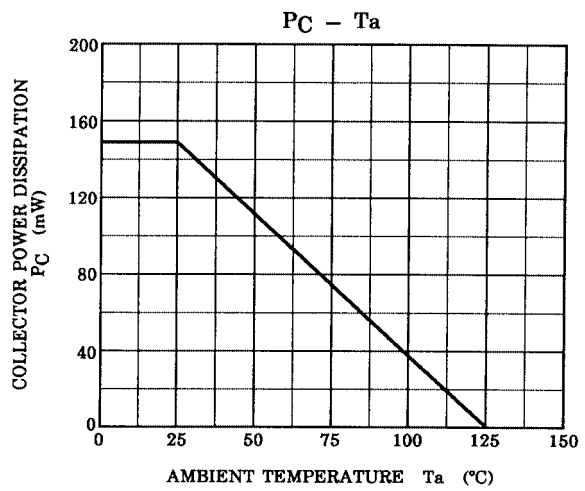
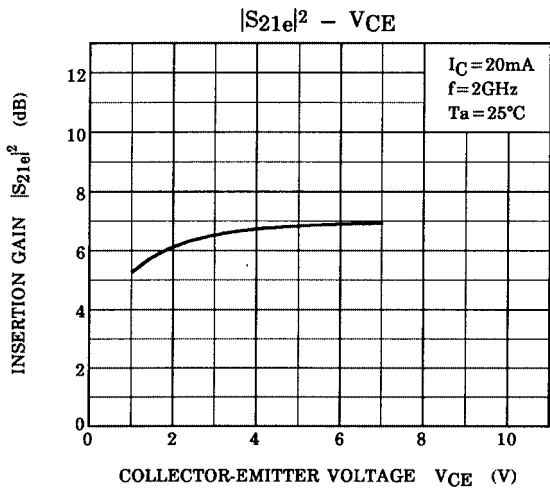
Note 1:  $h_{FE}$  classification R: 50~100, O: 80~160

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

**Marking**







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

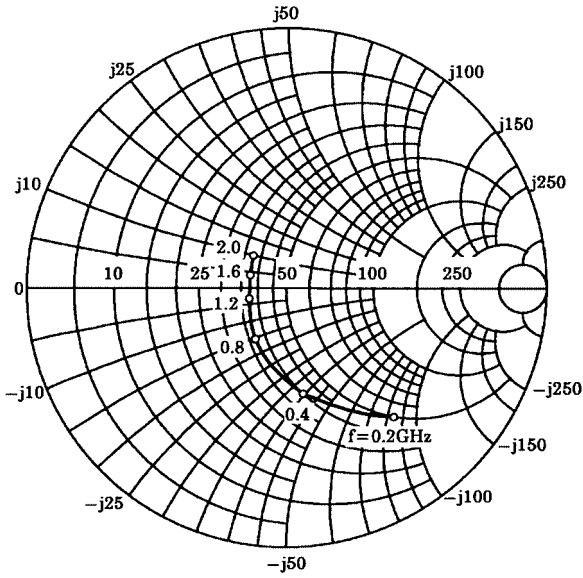
**V<sub>CE</sub> = 8 V, I<sub>C</sub> = 5 mA**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.653	-48.5	10.080	136.2	0.046	63.5	0.766	-27.9
400	0.420	-82.1	7.242	112.7	0.069	57.6	0.561	-35.0
600	0.284	-105.7	5.393	98.9	0.086	57.9	0.466	-35.4
800	0.214	-126.0	4.245	89.7	0.103	59.4	0.420	-34.9
1000	0.169	-146.7	3.508	82.2	0.121	60.6	0.394	-34.7
1200	0.155	-166.4	3.012	75.9	0.140	61.9	0.382	-35.1
1400	0.152	174.1	2.645	70.2	0.162	62.1	0.374	-36.1
1600	0.154	156.7	2.350	65.0	0.182	61.3	0.363	-38.5
1800	0.161	145.9	2.136	60.2	0.202	60.5	0.355	-41.0
2000	0.181	134.5	1.972	55.8	0.224	60.6	0.345	-44.0

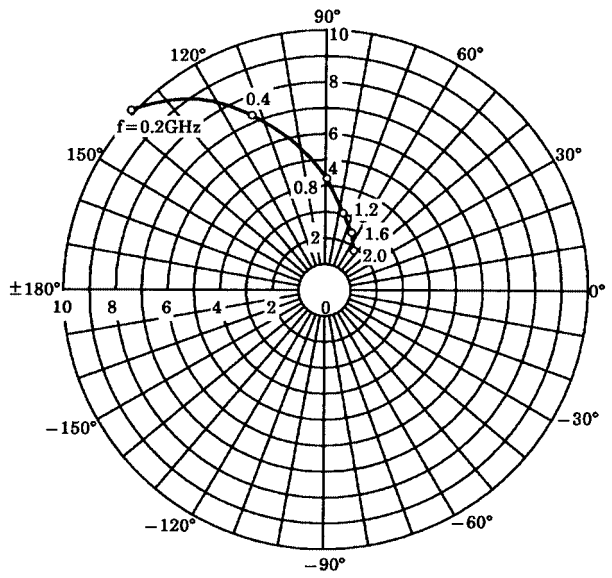
**V<sub>CE</sub> = 8 V, I<sub>C</sub> = 20 mA**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.275	-80.2	17.464	114.7	0.033	68.9	0.506	-36.6
400	0.147	-116.5	9.693	97.8	0.057	72.0	0.353	-32.4
600	0.097	-150.0	6.680	88.8	0.082	72.7	0.313	-27.9
800	0.083	179.5	5.088	82.3	0.106	72.1	0.300	-25.9
1000	0.084	151.3	4.141	76.7	0.131	71.2	0.295	-25.2
1200	0.095	135.6	3.497	72.2	0.156	69.8	0.295	-25.7
1400	0.108	124.2	3.058	67.7	0.182	67.7	0.297	-27.3
1600	0.121	113.8	2.699	63.2	0.206	65.2	0.289	-30.1
1800	0.128	108.4	2.432	59.2	0.228	63.0	0.283	-33.2
2000	0.146	104.2	2.241	55.5	0.253	61.6	0.274	-36.5

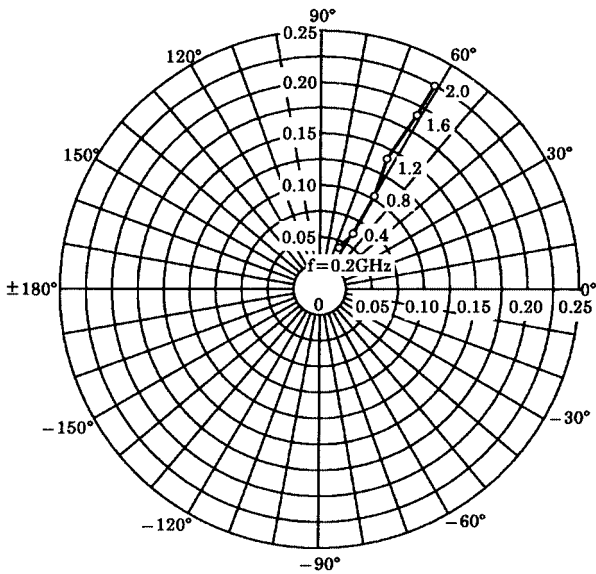
S11e  
 VCE=8V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



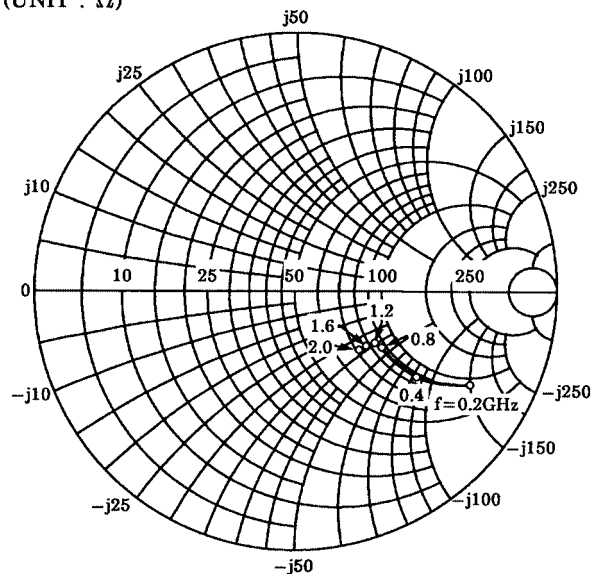
S21e  
 VCE=8V  
 IC=5mA  
 Ta=25°C



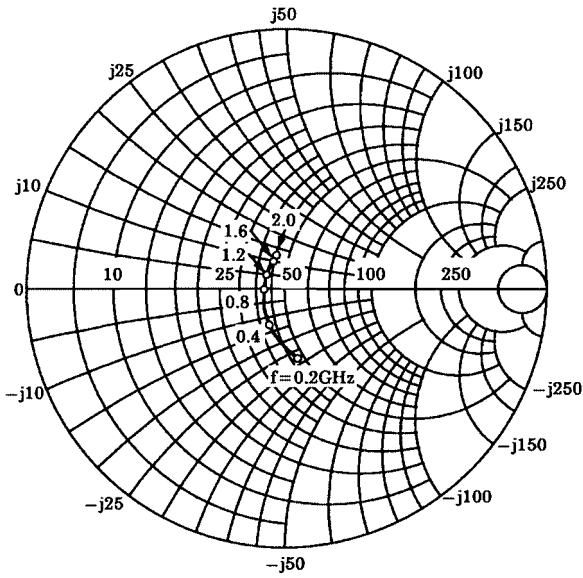
S12e  
 VCE=8V  
 IC=5mA  
 Ta=25°C



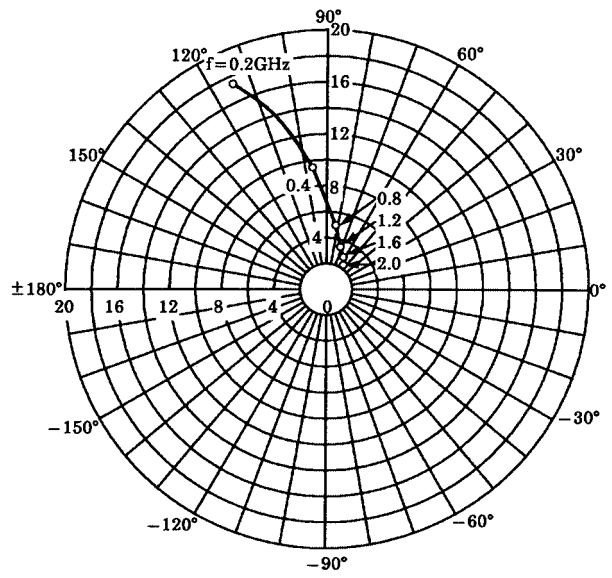
S22e  
 VCE=8V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



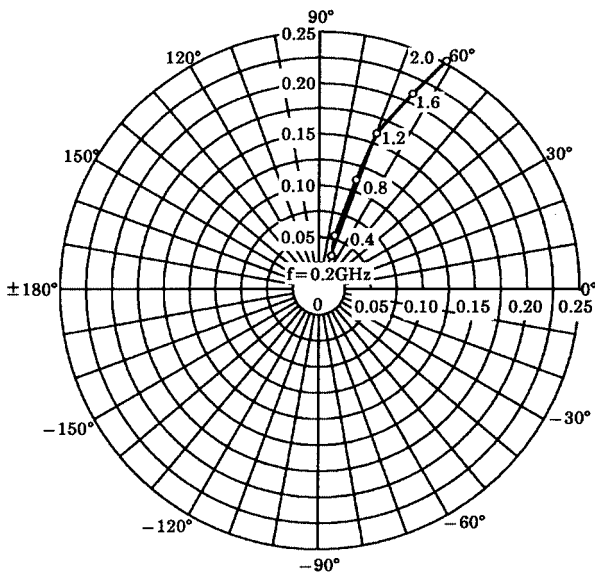
S11e  
 VCE=8V  
 IC=20mA  
 Ta=25°C  
 (UNIT : Ω)



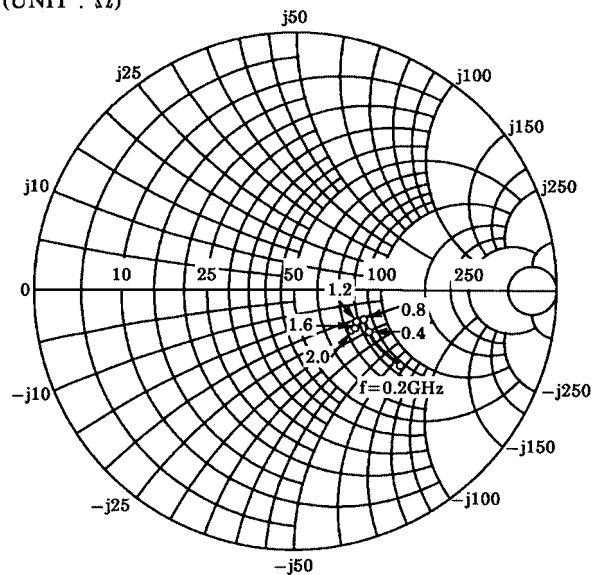
S21e  
 VCE=8V  
 IC=20mA  
 Ta=25°C



S12e  
 VCE=8V  
 IC=20mA  
 Ta=25°C



S22e  
 VCE=8V  
 IC=20mA  
 Ta=25°C  
 (UNIT : Ω)



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