

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5065

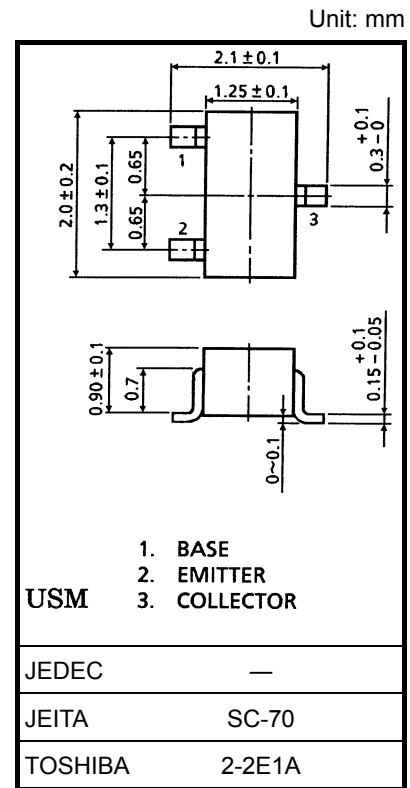
## VHF to UHF Band Low Noise Amplifier Applications

- Low noise figure, high gain.
- $NF = 1.1 \text{ dB}$ ,  $|S_{21e}|^2 = 12 \text{ dB}$  ( $f = 1 \text{ GHz}$ )

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	20	V
Collector-emitter voltage	$V_{CEO}$	12	V
Emitter-base voltage	$V_{EBO}$	3	V
Base current	$I_B$	15	mA
Collector current	$I_C$	30	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: 0.006 g (typ.)

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 5 \text{ V}$ , $I_C = 10 \text{ mA}$	5	7	—	GHz
Insertion gain	$ S_{21e} ^2 (1)$	$V_{CE} = 5 \text{ V}$ , $I_C = 10 \text{ mA}$ , $f = 500 \text{ MHz}$	—	17	—	dB
	$ S_{21e} ^2 (2)$	$V_{CE} = 5 \text{ V}$ , $I_C = 10 \text{ mA}$ , $f = 1 \text{ GHz}$	8.5	12	—	
Noise figure	NF (1)	$V_{CE} = 5 \text{ V}$ , $I_C = 3 \text{ mA}$ , $f = 500 \text{ MHz}$	—	1	—	dB
	NF (2)	$V_{CE} = 5 \text{ V}$ , $I_C = 3 \text{ mA}$ , $f = 1 \text{ GHz}$	—	1.1	2.0	

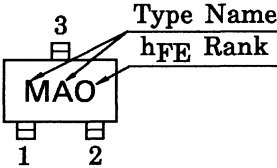
### Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

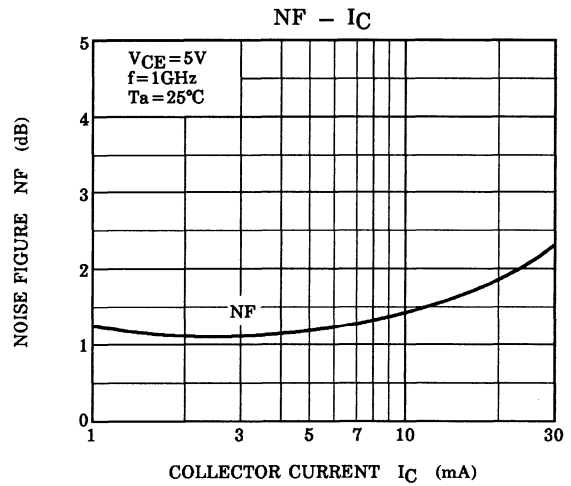
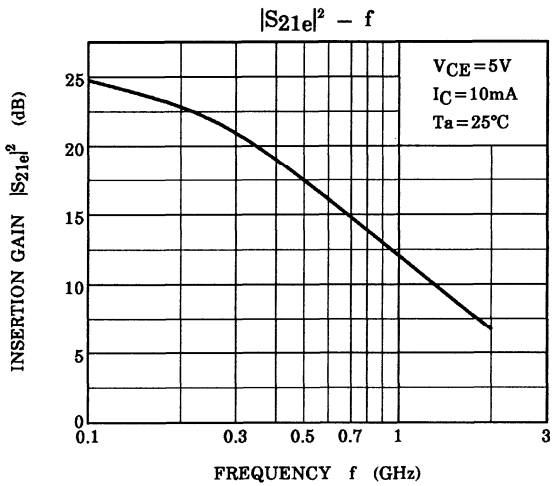
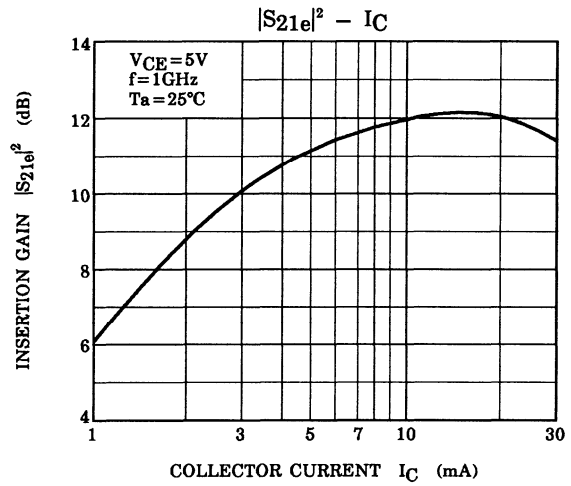
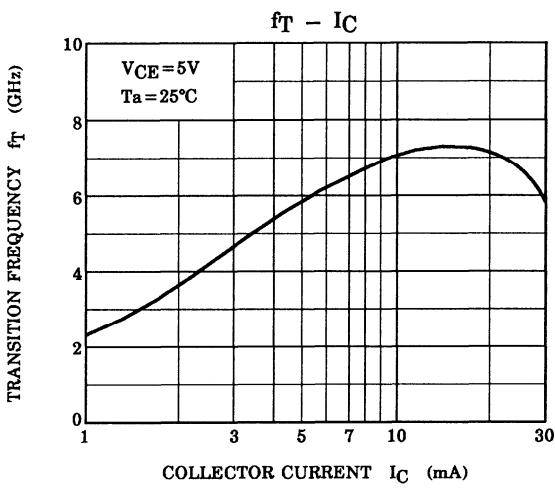
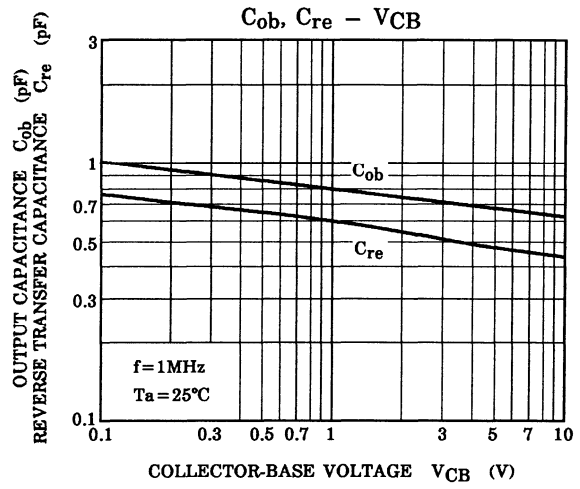
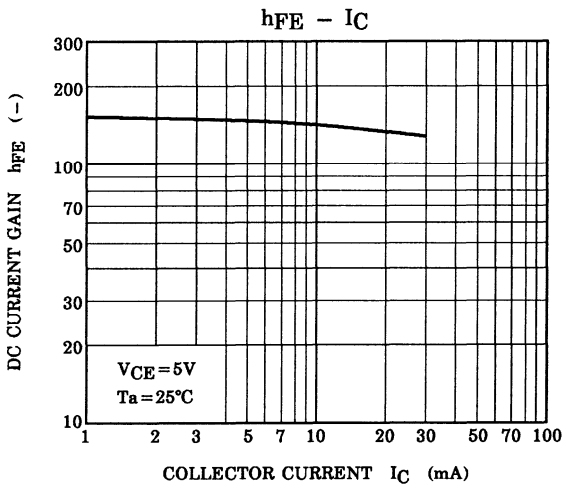
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 10 \text{ V}$ , $I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1 \text{ V}$ , $I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$ (Note 1)	$V_{CE} = 5 \text{ V}$ , $I_C = 10 \text{ mA}$	80	—	240	—
Output capacitance	$C_{ob}$	$V_{CB} = 5 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$ (Note 2)	—	0.7	—	pF
Reverse transfer capacitance	$C_{re}$		—	0.45	0.9	pF

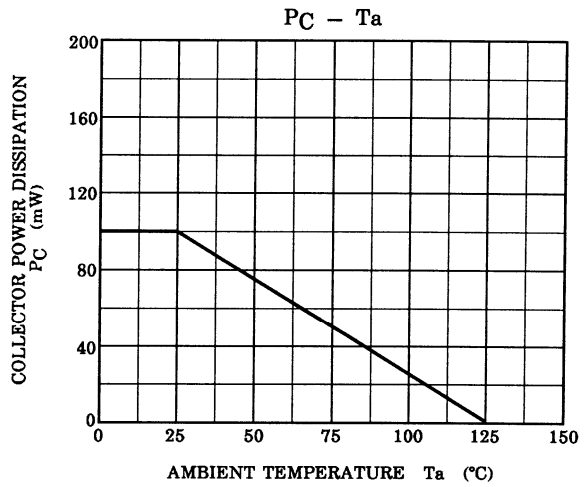
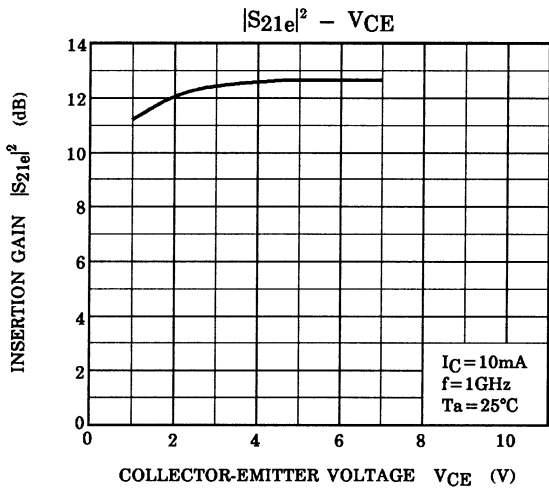
Note 1:  $h_{FE}$  classification O: 80 to 160, Y: 120 to 240

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

**Marking**







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

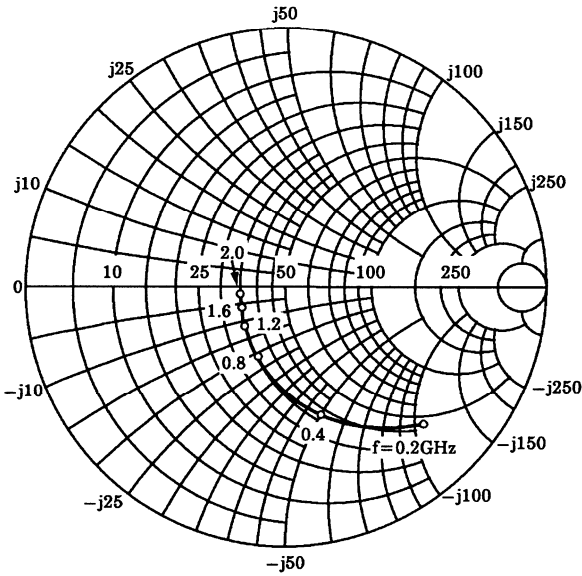
**$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.753	-43.7	10.247	140.6	0.040	65.6	0.827	-22.6
400	0.531	-75.1	7.684	117.1	0.060	57.1	0.648	-30.3
600	0.384	-96.4	5.815	103.0	0.074	56.1	0.551	-32.0
800	0.305	-112.6	4.523	93.6	0.086	57.0	0.500	-32.3
1000	0.255	-126.5	3.788	86.3	0.099	58.9	0.472	-32.4
1200	0.224	-138.4	3.244	80.7	0.112	60.2	0.455	-32.2
1400	0.203	-150.1	2.833	75.4	0.127	60.3	0.442	-32.6
1600	0.187	-159.4	2.529	70.6	0.139	60.0	0.434	-33.0
1800	0.174	-166.5	2.283	66.7	0.150	60.3	0.429	-32.6
2000	0.176	-171.2	2.107	63.0	0.164	59.2	0.428	-32.2

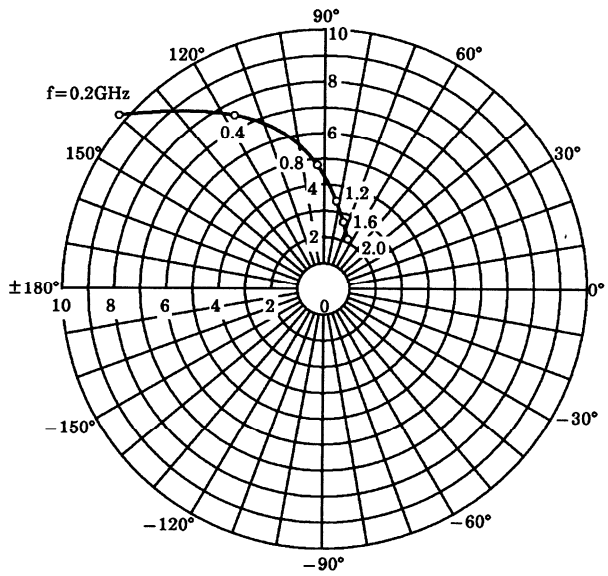
**$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.591	-58.0	14.955	129.6	0.034	64.3	0.714	-27.5
400	0.367	-90.3	9.581	107.5	0.052	61.9	0.534	-30.8
600	0.260	-110.7	6.781	96.1	0.067	63.9	0.462	-30.1
800	0.209	-126.9	5.207	88.6	0.083	65.2	0.428	-29.2
1000	0.178	-141.8	4.269	82.5	0.100	66.4	0.412	-28.6
1200	0.160	-153.7	3.618	77.7	0.117	66.7	0.403	-28.3
1400	0.150	-166.3	3.152	72.7	0.135	65.4	0.398	-28.8
1600	0.141	-175.2	2.801	68.7	0.149	64.0	0.393	-29.4
1800	0.130	-178.2	2.521	65.0	0.163	63.4	0.392	-29.0
2000	0.133	-174.0	2.314	61.7	0.179	61.3	0.395	-28.6

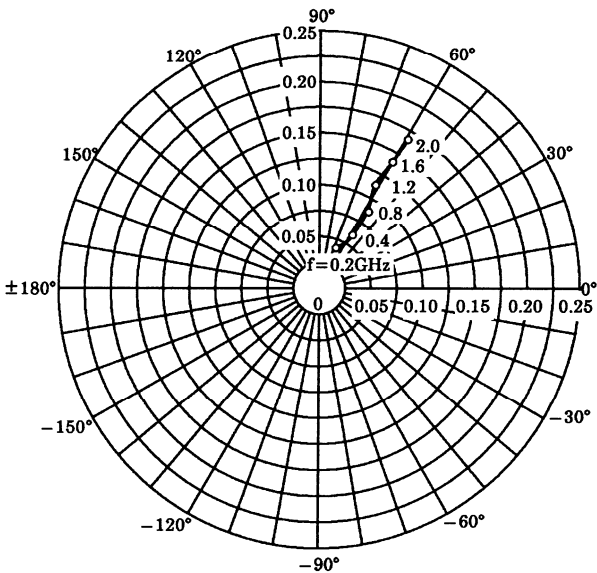
**S<sub>11e</sub>**  
 V<sub>CE</sub> = 5V  
 I<sub>C</sub> = 5mA  
 T<sub>a</sub> = 25°C  
 (UNIT : Ω)



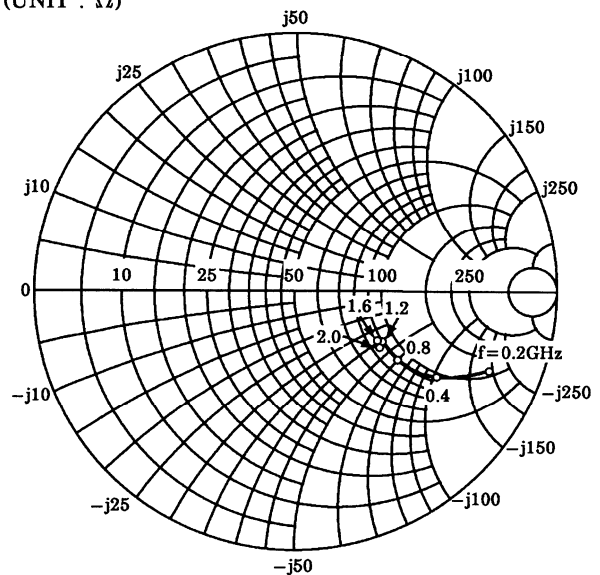
**S<sub>21e</sub>**  
 V<sub>CE</sub> = 5V  
 I<sub>C</sub> = 5mA  
 T<sub>a</sub> = 25°C



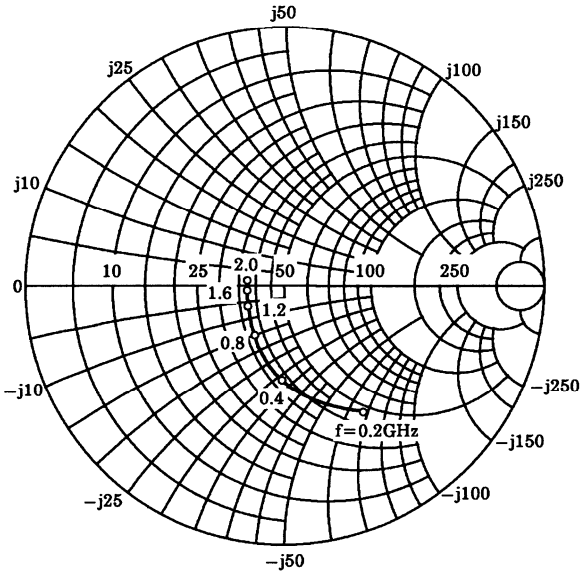
**S<sub>12e</sub>**  
 V<sub>CE</sub> = 5V  
 I<sub>C</sub> = 5mA  
 T<sub>a</sub> = 25°C



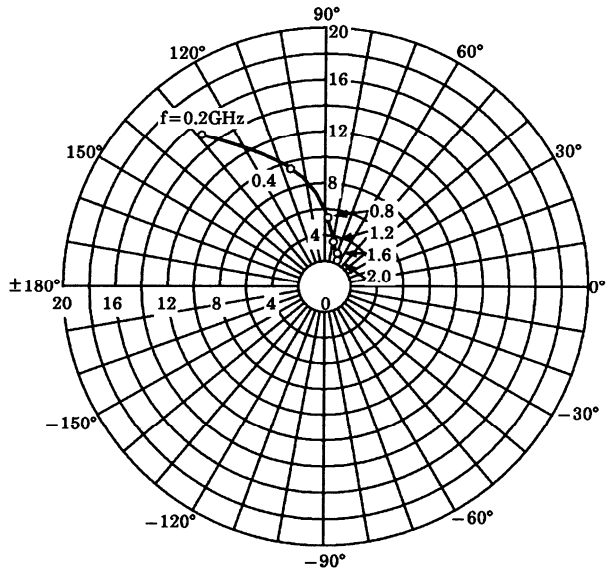
**S<sub>22e</sub>**  
 V<sub>CE</sub> = 5V  
 I<sub>C</sub> = 5mA  
 T<sub>a</sub> = 25°C  
 (UNIT : Ω)



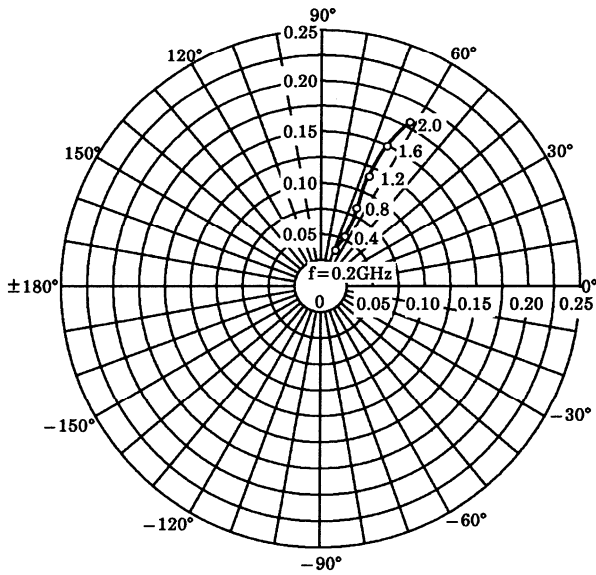
S11e  
 VCE=5V  
 IC=10mA  
 Ta=25°C  
 (UNIT : Ω)



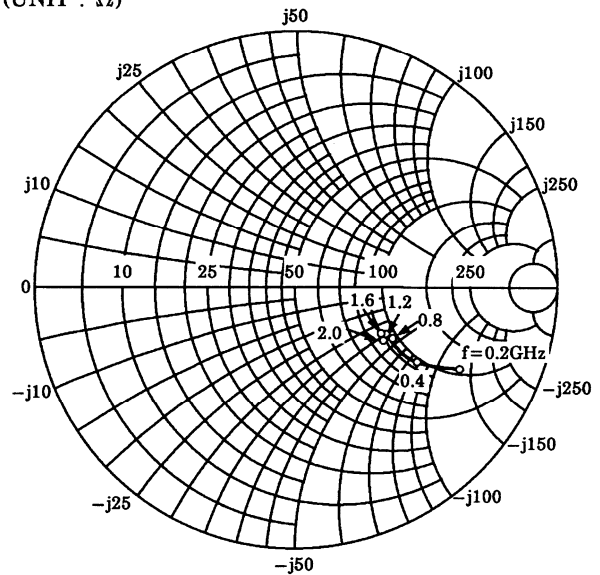
S21e  
 VCE=5V  
 IC=10mA  
 Ta=25°C



S12e  
 VCE=5V  
 IC=10mA  
 Ta=25°C



S22e  
 VCE=5V  
 IC=10mA  
 Ta=25°C  
 (UNIT : Ω)



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