

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5087

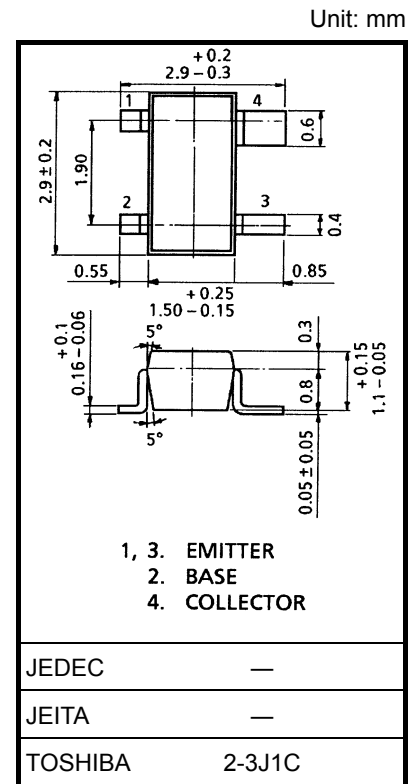
## VHF~UHF Band Low Noise Amplifier Applications

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

### 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	$I_B$	40	mA
Collector current	$I_C$	80	mA
Collector power dissipation	$P_C$	150	mW
Junction temperature	$T_j$	125	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~125	$^\circ\text{C}$

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: 0.012 g (typ.)

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$	5	7	—	GHz
Insertion gain	$ S_{21e} ^2$ (1)	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$ , $f = 500\text{MHz}$	—	18	—	dB
	$ S_{21e} ^2$ (2)	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$ , $f = 1\text{GHz}$	9.5	13	—	
Noise figure	NF (1)	$V_{CE} = 10\text{V}$ , $I_C = 5\text{mA}$ , $f = 500\text{MHz}$	—	1	—	dB
	NF (2)	$V_{CE} = 10\text{V}$ , $I_C = 5\text{mA}$ , $f = 1\text{GHz}$	—	1.1	2	

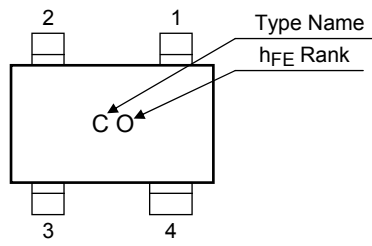
### Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

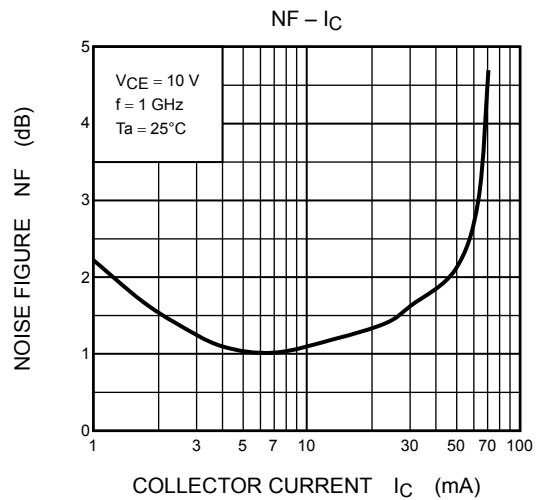
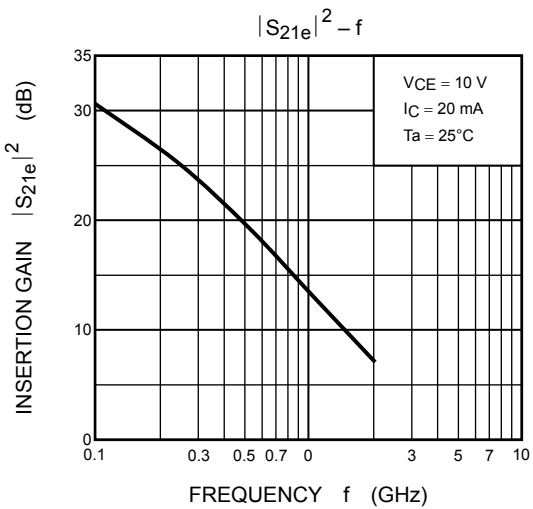
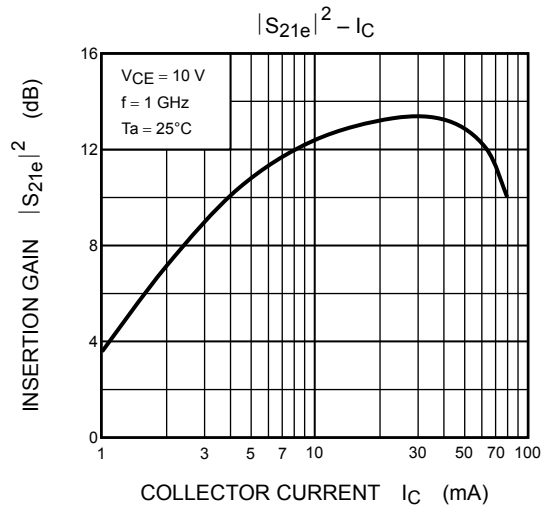
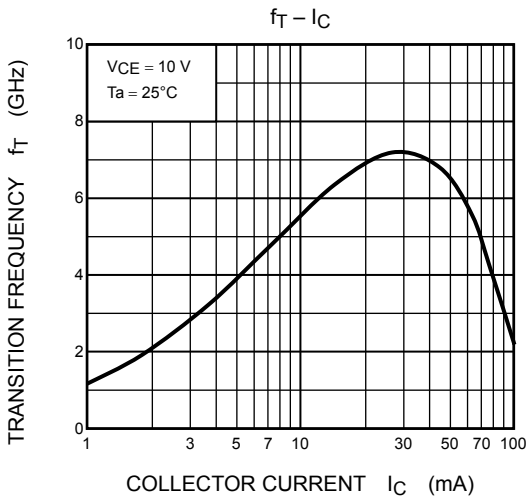
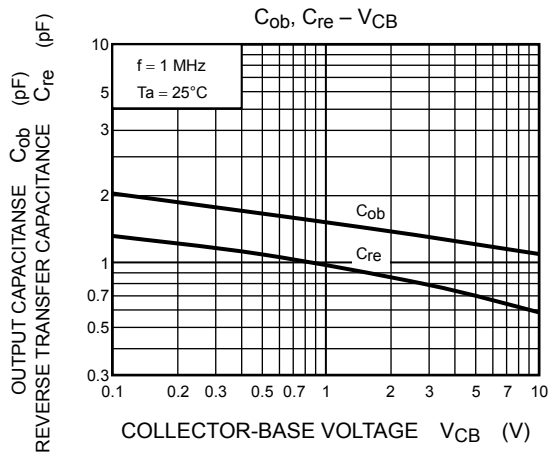
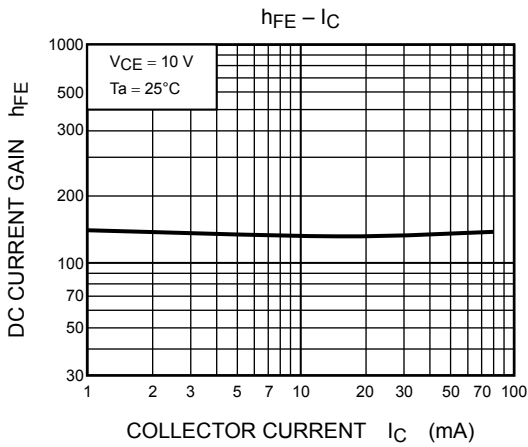
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 10\text{V}$ , $I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{V}$ , $I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$ (Note 1)	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$	80	—	240	
Output capacitance	$C_{ob}$	$V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$ (Note 2)	—	1.1	1.6	pF
Reverse transfer capacitance	$C_{re}$		—	0.65	1.05	pF

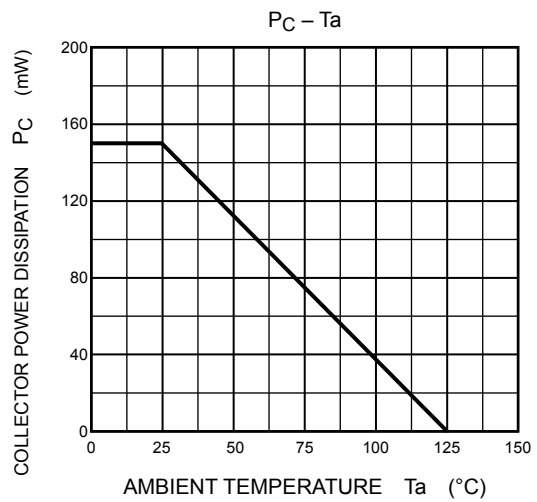
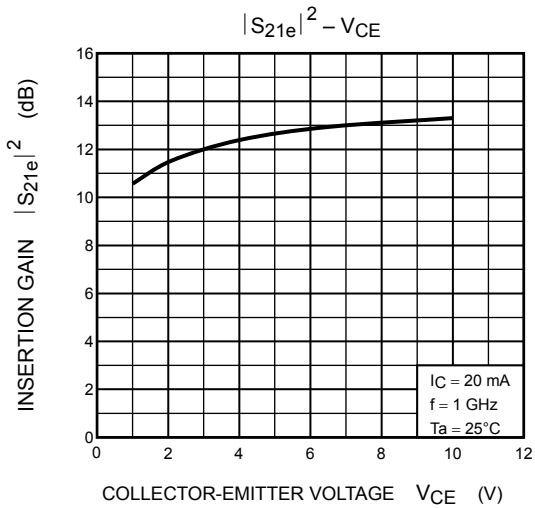
Note 1:  $h_{FE}$  classification O: 80~160, Y: 120~240

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

## Marking







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

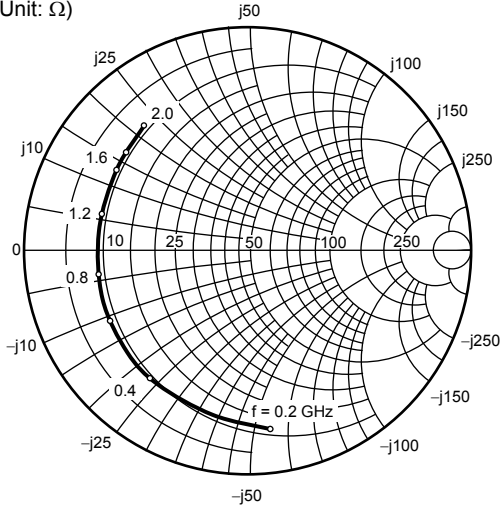
**$V_{CE} = 10 \text{ V}$ ,  $I_C = 5 \text{ mA}$**

Frequency MHz	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.793	-82.4	11.923	133.4	0.050	52.7	0.788	-36.4
400	0.736	-128.0	7.835	108.5	0.066	38.0	0.584	-53.4
600	0.719	-152.1	5.578	94.5	0.071	34.1	0.490	-63.5
800	0.701	-168.6	4.279	84.4	0.073	33.9	0.445	-72.2
1000	0.698	178.9	3.451	76.6	0.074	36.7	0.424	-80.5
1200	0.697	168.3	2.855	69.9	0.076	40.8	0.413	-88.9
1400	0.699	159.4	2.440	64.0	0.078	46.6	0.404	-97.3
1600	0.703	150.8	2.121	59.3	0.084	52.5	0.401	-105.4
1800	0.713	142.9	1.876	54.5	0.091	58.3	0.398	-112.6
2000	0.722	134.7	1.681	50.3	0.100	63.5	0.398	-119.6

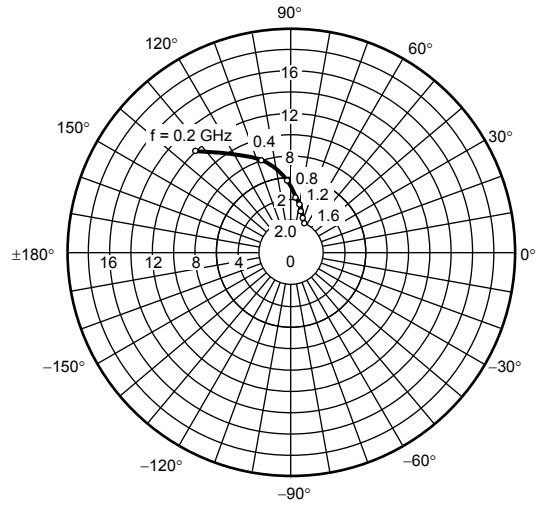
**$V_{CE} = 10 \text{ V}$ ,  $I_C = 20 \text{ mA}$**

Frequency MHz	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.655	-129.4	20.724	113.2	0.031	48.0	0.496	-59.6
400	0.650	-161.5	11.288	95.5	0.040	50.4	0.319	-74.1
600	0.660	-176.3	7.643	86.4	0.049	56.4	0.263	-83.5
800	0.666	172.8	5.758	79.6	0.059	60.0	0.242	-92.9
1000	0.667	164.0	4.605	74.2	0.070	63.6	0.233	-102.0
1200	0.668	156.8	3.809	69.3	0.080	65.9	0.229	-111.0
1400	0.677	148.4	3.277	65.1	0.091	68.2	0.226	-119.1
1600	0.676	141.1	2.862	61.2	0.104	70.0	0.223	-126.5
1800	0.688	133.9	2.559	57.5	0.117	71.2	0.220	-132.4
2000	0.690	126.7	2.303	54.1	0.131	72.4	0.217	-137.8

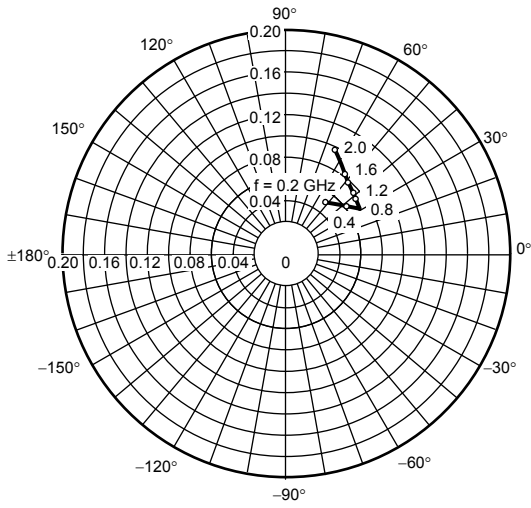
S<sub>11e</sub>  
 V<sub>CE</sub> = 10 V  
 I<sub>C</sub> = 5 mA  
 T<sub>a</sub> = 25°C  
 (Unit: Ω)



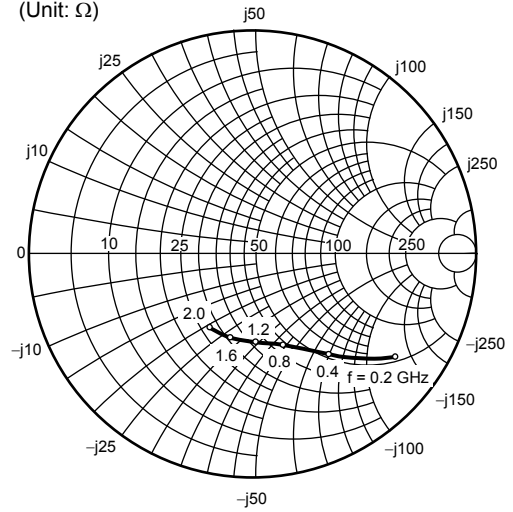
S<sub>21e</sub>  
 V<sub>CE</sub> = 10 V  
 I<sub>C</sub> = 5 mA  
 T<sub>a</sub> = 25°C



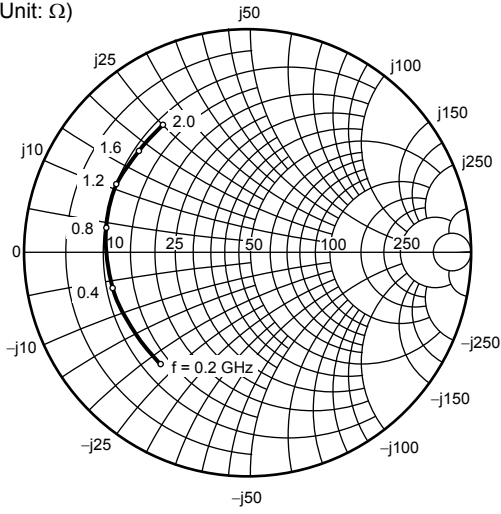
S<sub>12e</sub>  
 V<sub>CE</sub> = 10 V  
 I<sub>C</sub> = 5 mA  
 T<sub>a</sub> = 25°C



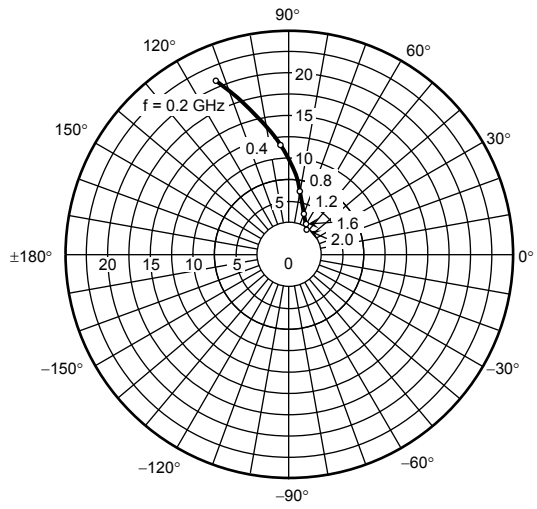
S<sub>22e</sub>  
 V<sub>CE</sub> = 10 V  
 I<sub>C</sub> = 5 mA  
 T<sub>a</sub> = 25°C  
 (Unit: Ω)



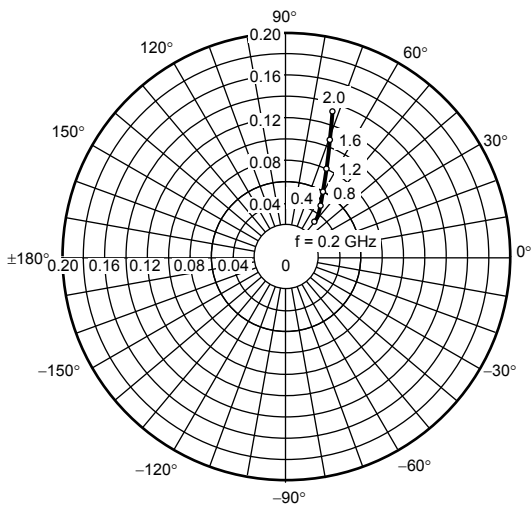
S11e  
 $V_{CE} = 10\text{ V}$   
 $I_C = 20\text{ mA}$   
 $T_a = 25^\circ\text{C}$   
 (Unit:  $\Omega$ )



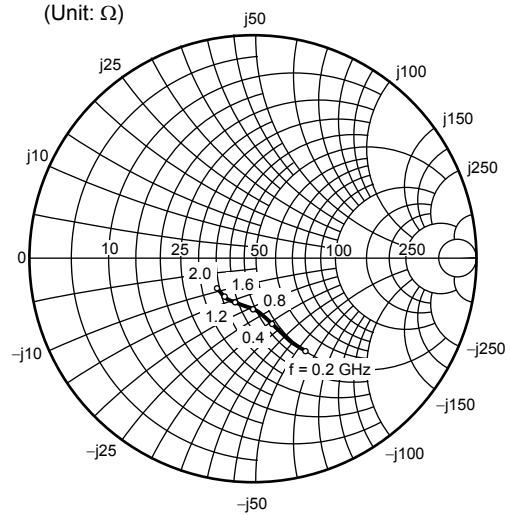
S21e  
 $V_{CE} = 10\text{ V}$   
 $I_C = 20\text{ mA}$   
 $T_a = 25^\circ\text{C}$



S12e  
 $V_{CE} = 10\text{ V}$   
 $I_C = 20\text{ mA}$   
 $T_a = 25^\circ\text{C}$



S22e  
 $V_{CE} = 10\text{ V}$   
 $I_C = 20\text{ mA}$   
 $T_a = 25^\circ\text{C}$   
 (Unit:  $\Omega$ )



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