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TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5086

## VHF~UHF Band Low Noise Amplifier Applications

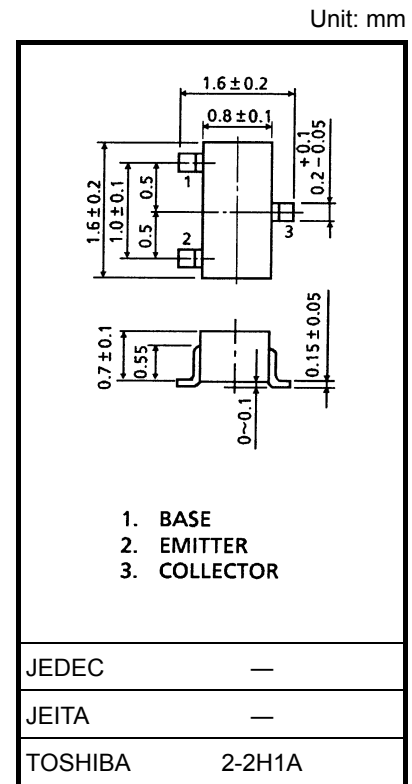
- Low noise figure, high gain.
- $NF = 1.1\text{dB}$ ,  $|S_{21e}|^2 = 11\text{dB}$  ( $f = 1\text{GHz}$ )

### 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	$P_C$	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	$f_T$	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$	5	7	—	GHz
Insertion gain	$ S_{21e} ^2$ (1)	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$ , $f = 500\text{MHz}$	—	16.5	—	dB
	$ S_{21e} ^2$ (2)	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$ , $f = 1\text{GHz}$	7.5	11	—	
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 ( $T_a = 25^\circ\text{C}$ )

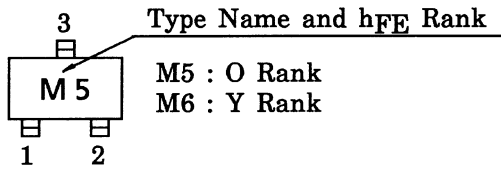
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 10\text{V}$ , $I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{V}$ , $I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$ (Note 1)	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$	80	—	240	
Output capacitance	$C_{ob}$	$V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$ (Note 2)	—	1.0	—	pF
Reverse transfer capacitance	$C_{re}$		—	0.65	1.15	pF

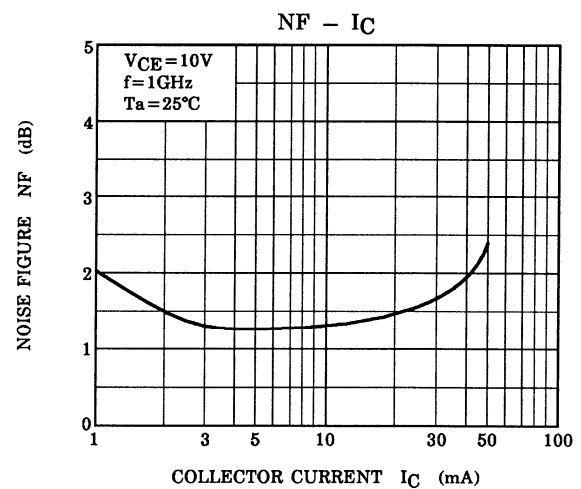
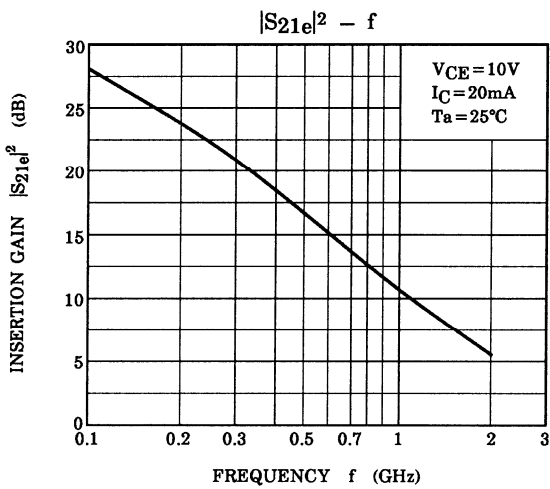
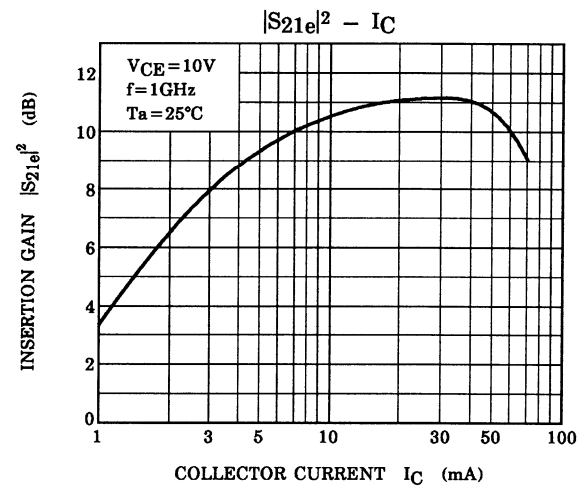
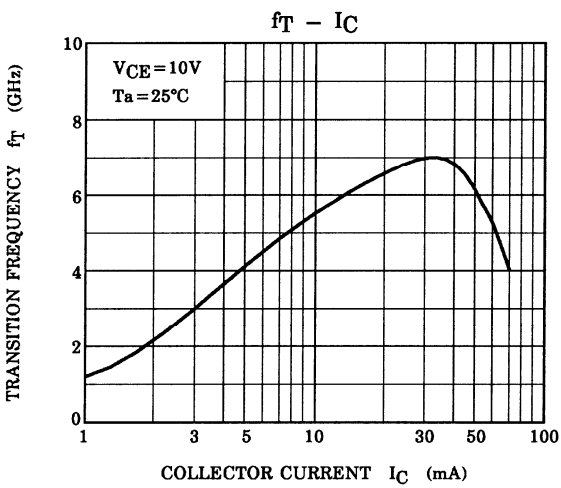
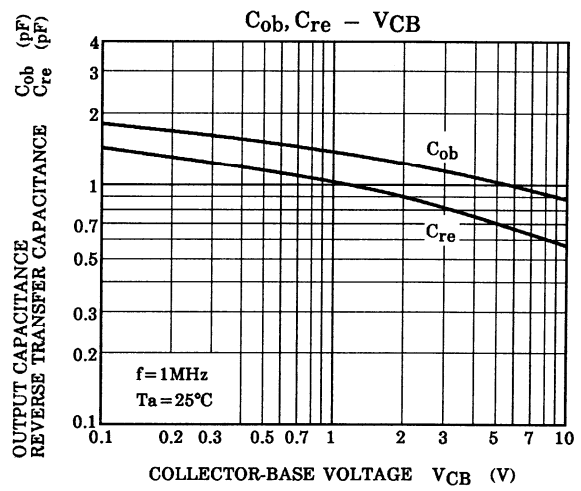
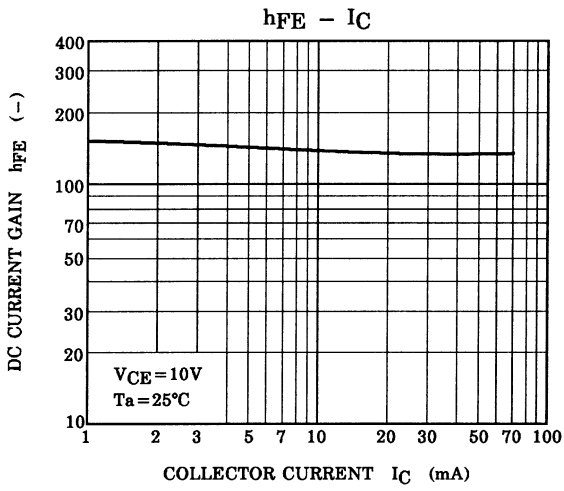
Note 1:  $h_{FE}$  classification O: 80 to 160, Y: 120 to 240

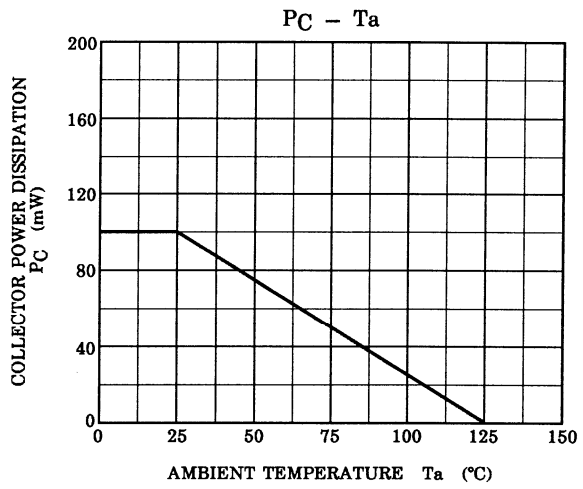
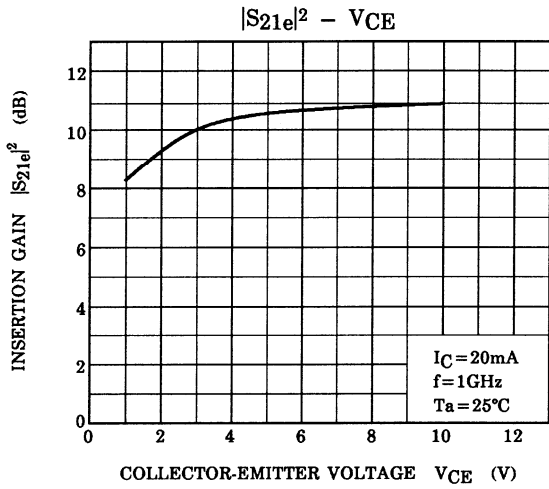
Note 2:  $C_{re}$  is measured by 3 terminal method with capacitance bridge.

Start of commercial production  
1993-10

## Marking







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

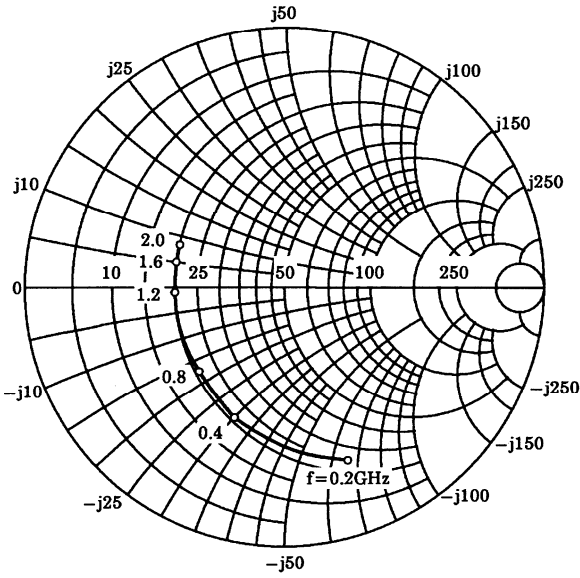
**$V_{CE} = 10 \text{ V}, I_C = 5 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.715	-69.3	9.495	132.1	0.051	55.2	0.747	-29.0
400	0.542	-112.4	6.482	108.5	0.068	46.8	0.555	-35.1
600	0.476	-137.7	4.717	95.8	0.077	47.9	0.478	-36.2
800	0.447	-154.4	3.691	87.1	0.086	51.6	0.442	-37.1
1000	0.435	-166.8	3.049	79.9	0.096	55.9	0.424	-38.9
1200	0.433	-176.6	2.611	73.9	0.108	60.4	0.418	-41.8
1400	0.435	174.8	2.294	68.3	0.123	64.2	0.411	-45.0
1600	0.439	167.3	2.050	63.2	0.140	66.9	0.407	-49.0
1800	0.444	160.6	1.860	58.7	0.159	68.7	0.406	-53.6
2000	0.454	154.2	1.713	53.9	0.180	70.5	0.404	-57.8

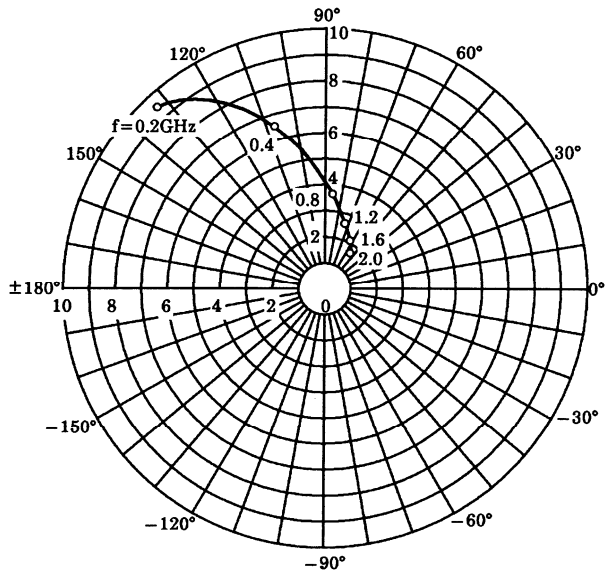
**$V_{CE} = 10 \text{ V}, I_C = 20 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.465	-107.8	16.512	113.2	0.035	56.7	0.484	-40.9
400	0.375	-145.6	9.090	96.5	0.052	62.2	0.331	-37.8
600	0.351	-164.4	6.252	88.1	0.070	66.5	0.291	-34.1
800	0.343	-176.7	4.762	81.9	0.089	68.9	0.277	-33.3
1000	0.338	174.8	3.875	76.6	0.109	70.2	0.273	-34.0
1200	0.337	167.9	3.285	71.8	0.130	70.8	0.274	-36.2
1400	0.343	161.6	2.874	67.2	0.152	70.6	0.274	-39.3
1600	0.343	156.2	2.553	62.9	0.173	69.8	0.274	-43.4
1800	0.348	151.2	2.317	58.8	0.195	68.9	0.273	-47.8
2000	0.354	146.2	2.113	55.0	0.218	68.2	0.272	-52.1

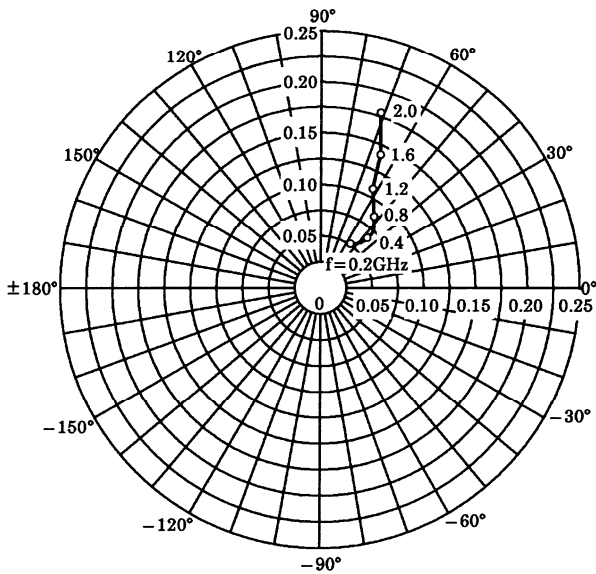
S11e  
 VCE=10V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



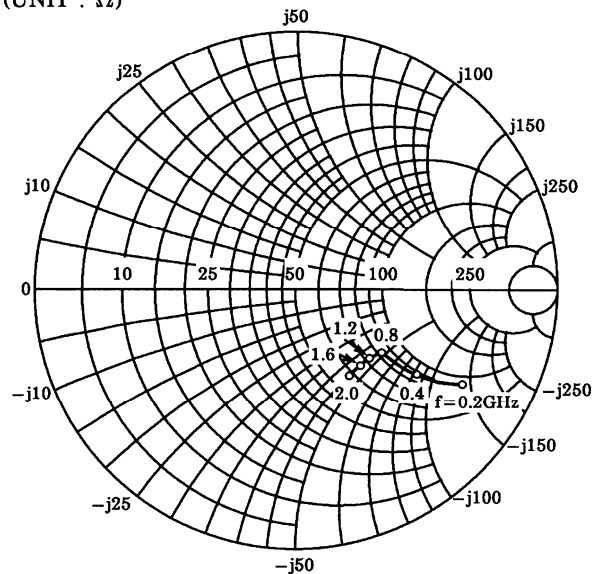
S21e  
 VCE=10V  
 IC=5mA  
 Ta=25°C



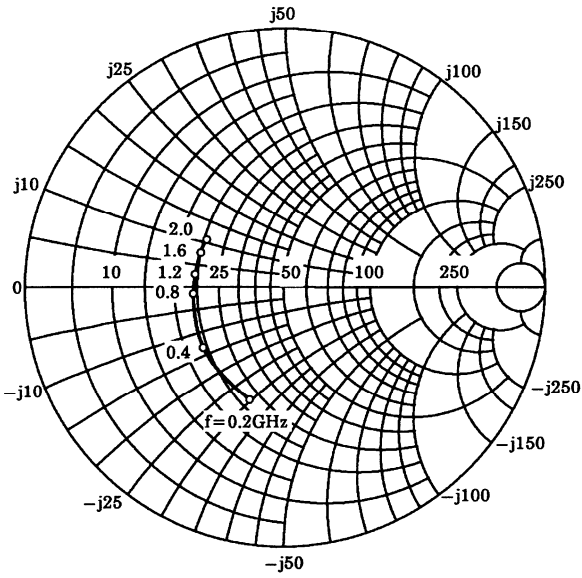
S12e  
 VCE=10V  
 IC=5mA  
 Ta=25°C



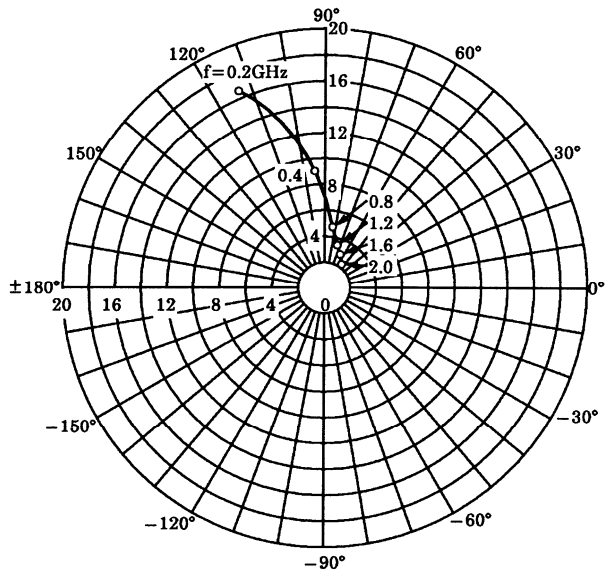
S22e  
 VCE=10V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



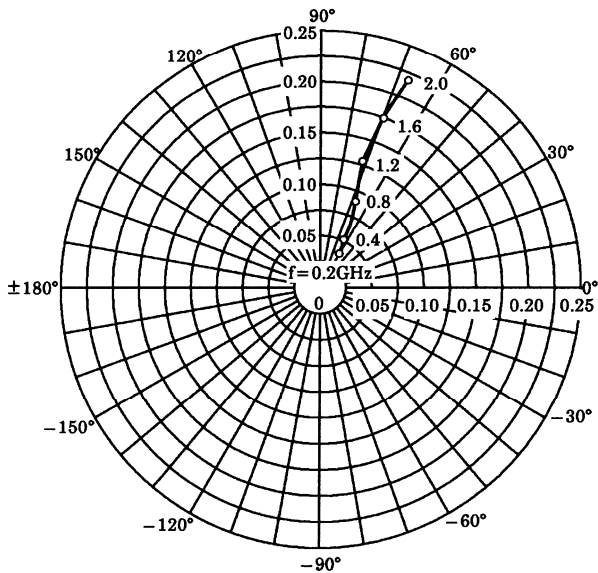
**S11e**  
**VCE = 10V**  
**IC = 20mA**  
**Ta = 25°C**  
 (UNIT : Ω)



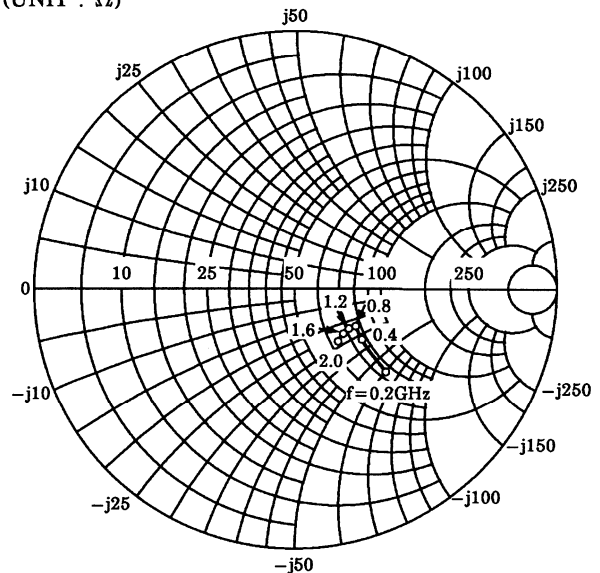
**S21e**  
**VCE = 10V**  
**IC = 20mA**  
**Ta = 25°C**



**S12e**  
**VCE = 10V**  
**IC = 20mA**  
**Ta = 25°C**



**S22e**  
**VCE = 10V**  
**IC = 20mA**  
**Ta = 25°C**  
 (UNIT : Ω)



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