

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5088

VHF~UHF Band Low Noise Amplifier Applications

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

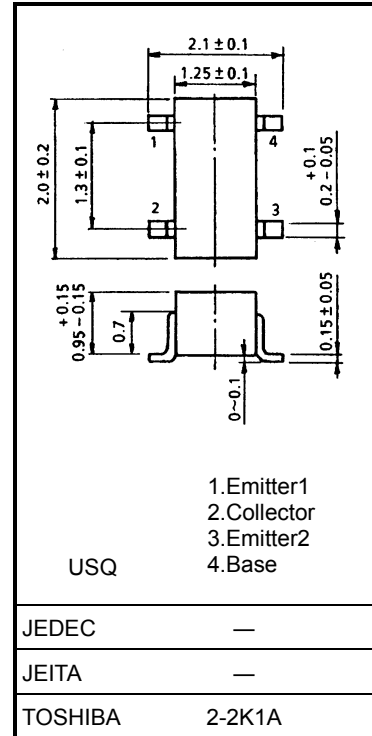
### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

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	$P_C$	100	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).

Unit: mm



Weight: 0.006 g (typ.)

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$	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	

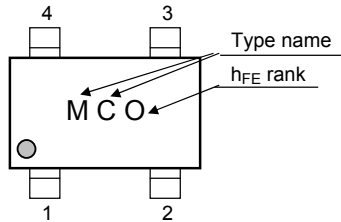
**Electrical Characteristics (Ta = 25°C)**

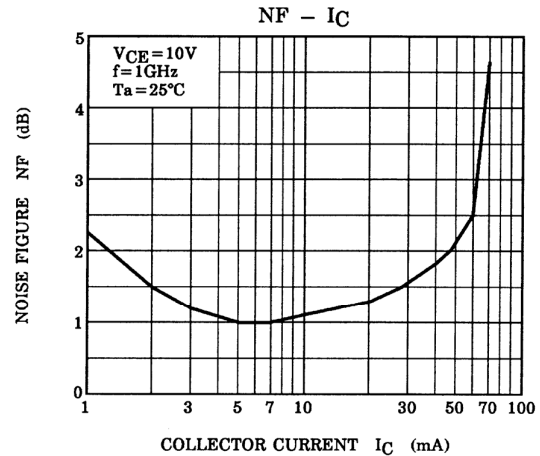
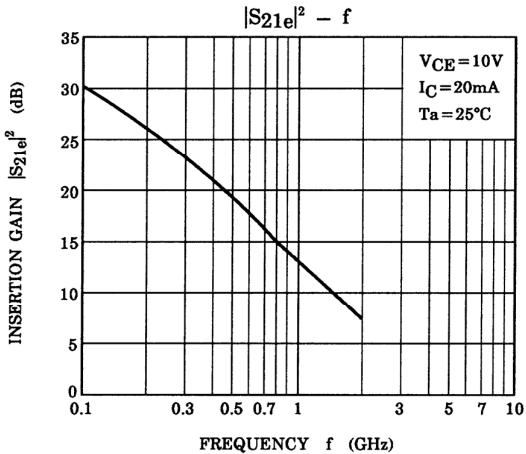
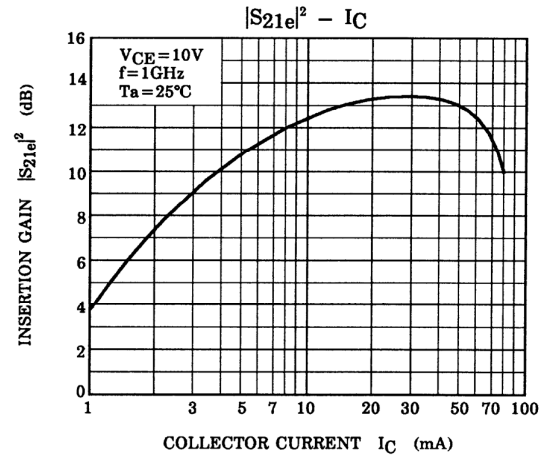
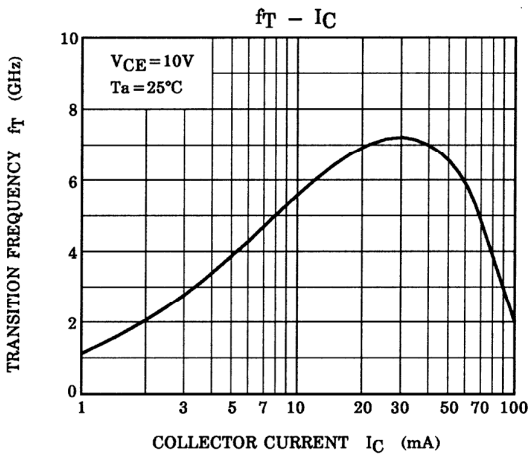
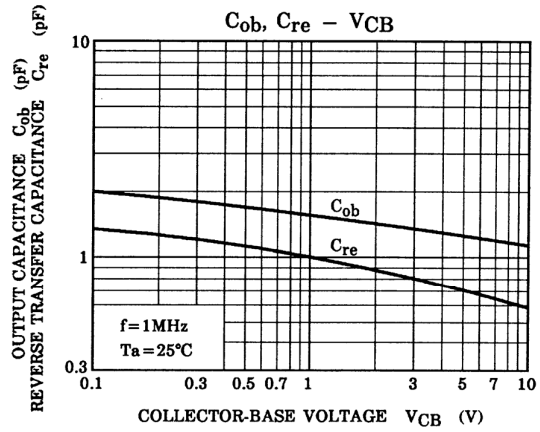
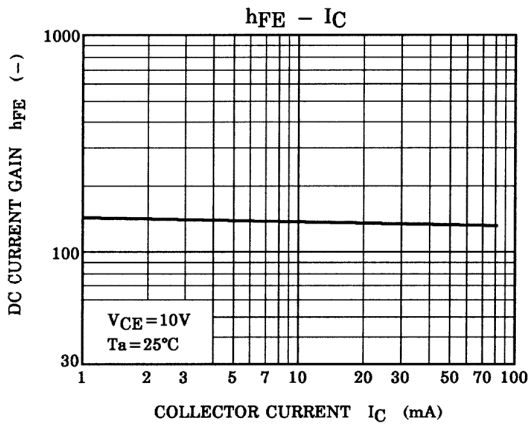
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 10\text{ V}, I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{ V}, I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$ (Note 1)	$V_{CE} = 10\text{ V}, I_C = 20\text{ mA}$	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

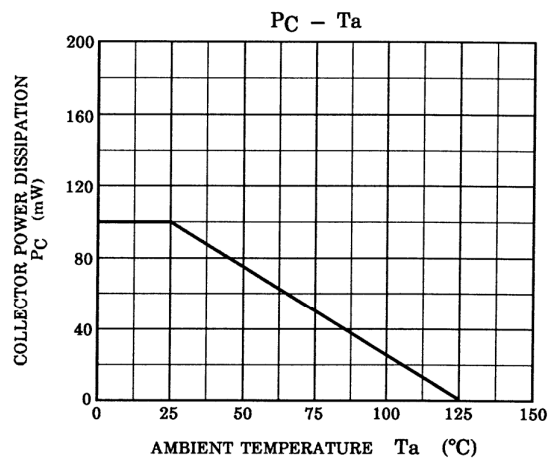
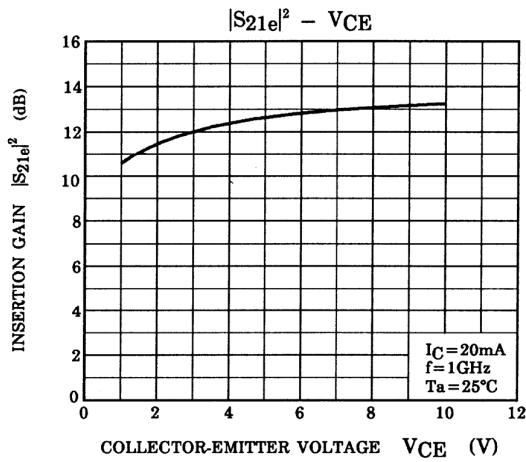
Note 1:  $h_{FE}$  classification O: 80~160, Y: 120~240

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

**Marking**







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

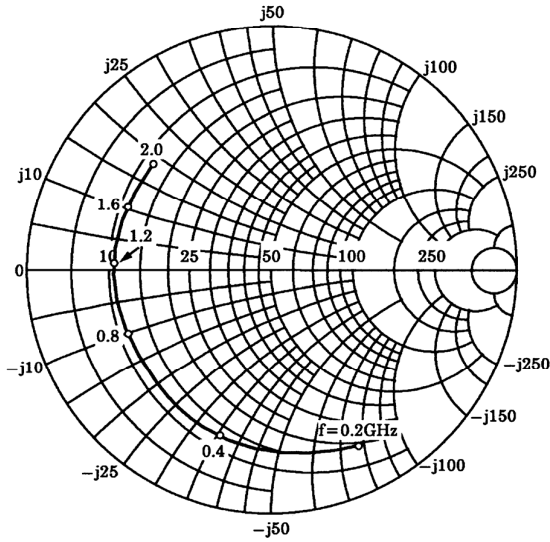
**$V_{CE} = 10 \text{ V}$ ,  $I_C = 5 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.826	-64.3	9.839	139.2	0.056	59.2	0.844	-31.7
400	0.735	-106.8	7.058	115.2	0.083	43.8	0.663	-50.1
600	0.692	-134.4	5.233	99.5	0.094	36.8	0.558	-62.3
800	0.666	-154.3	4.106	88.1	0.100	33.3	0.496	-72.6
1000	0.656	-170.0	3.315	78.9	0.102	32.7	0.458	-81.8
1200	0.653	178.0	2.768	71.3	0.103	33.4	0.429	-90.6
1400	0.649	167.7	2.353	65.4	0.104	36.0	0.407	-99.4
1600	0.655	158.2	2.061	59.6	0.107	39.1	0.393	-107.8
1800	0.653	149.0	1.818	55.3	0.111	42.6	0.378	-115.3
2000	0.654	139.9	1.650	50.7	0.116	46.7	0.367	-121.9

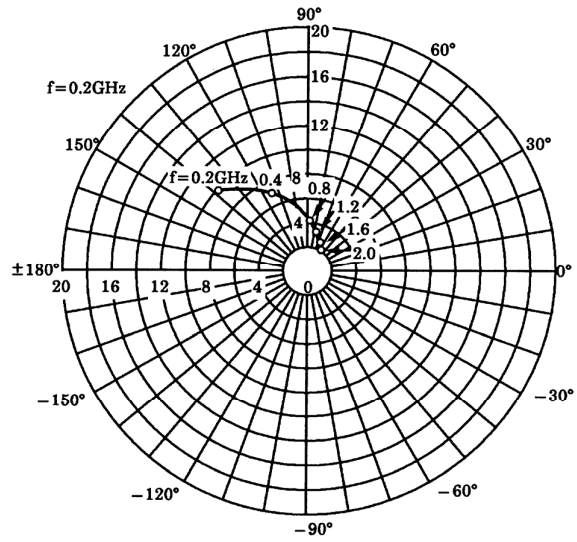
**$V_{CE} = 10 \text{ V}$ ,  $I_C = 20 \text{ mA}$**

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.747	-87.0	16.492	129.8	0.048	52.1	0.717	-47.1
400	0.675	-130.5	10.431	106.5	0.063	41.8	0.486	-69.1
600	0.648	-154.8	7.298	93.5	0.070	40.8	0.379	-82.0
800	0.636	-170.9	5.547	84.4	0.076	42.0	0.324	-93.0
1000	0.630	176.7	4.423	77.5	0.083	44.7	0.291	-102.7
1200	0.634	166.4	3.660	71.7	0.089	47.7	0.266	-112.1
1400	0.634	157.1	3.125	67.0	0.097	50.8	0.249	-120.8
1600	0.639	148.8	2.741	62.4	0.105	53.2	0.233	-128.9
1800	0.645	139.9	2.451	58.8	0.115	55.6	0.220	-135.8
2000	0.642	131.4	2.233	54.9	0.126	58.1	0.205	-141.2

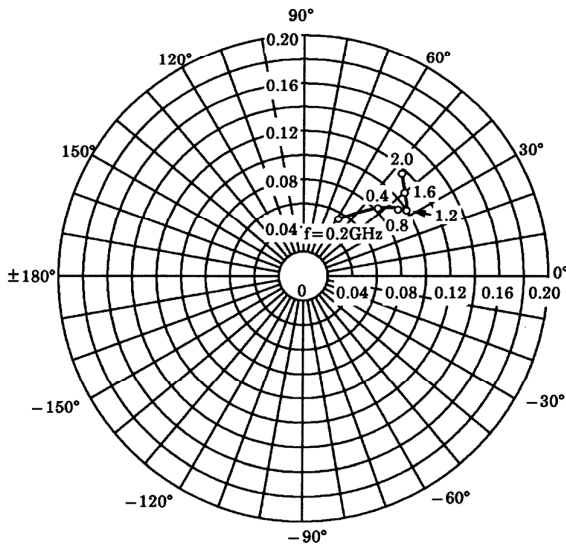
S11e  
 VCE=10V  
 IC=5mA  
 Ta=25°C  
 (Unit : Ω)



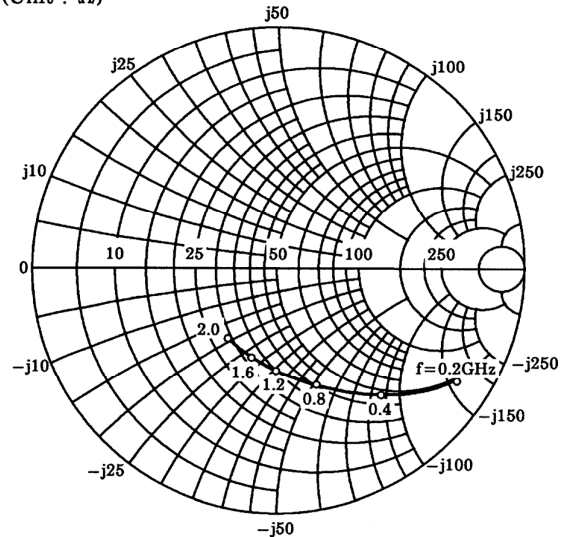
S21e  
 VCE=10V  
 IC=5mA  
 Ta=25°C



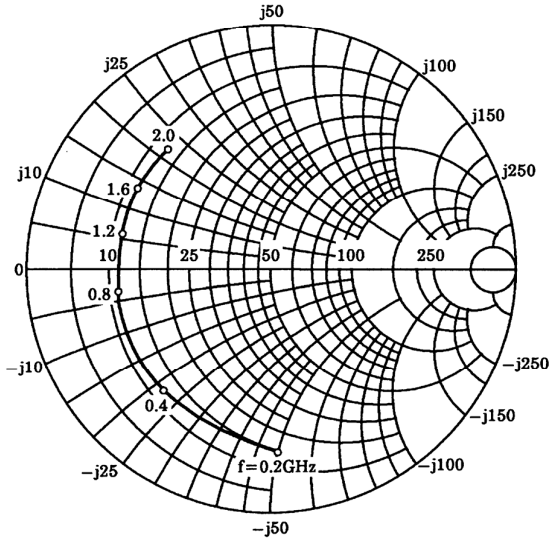
S12e  
 VCE=10V  
 IC=5mA  
 Ta=25°C



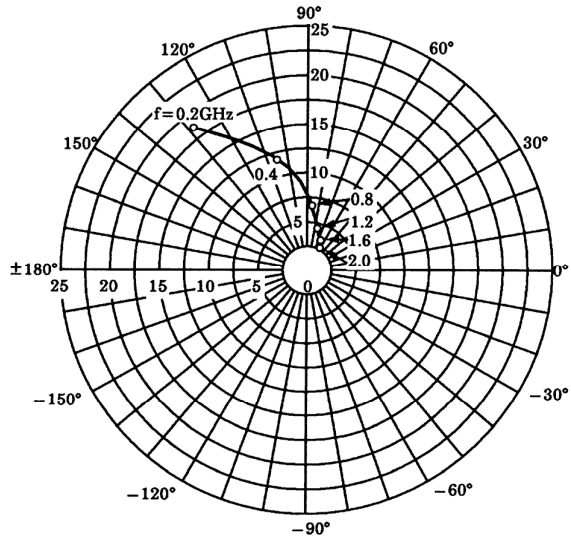
S22e  
 VCE=10V  
 IC=5mA  
 Ta=25°C  
 (Unit : Ω)



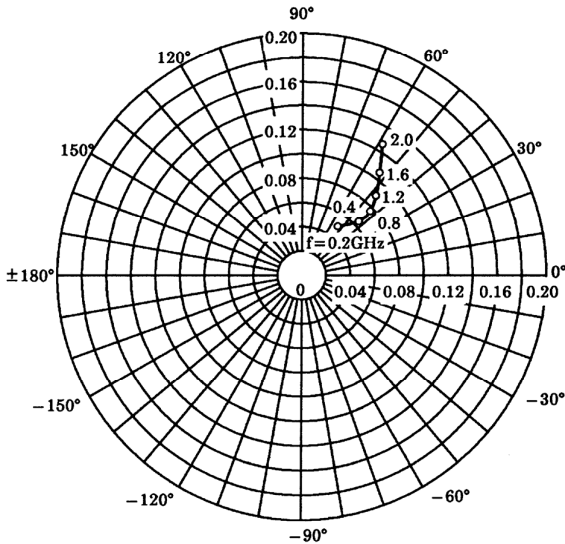
**S<sub>11e</sub>**  
 V<sub>CE</sub> = 10V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C  
 (Unit : Ω)



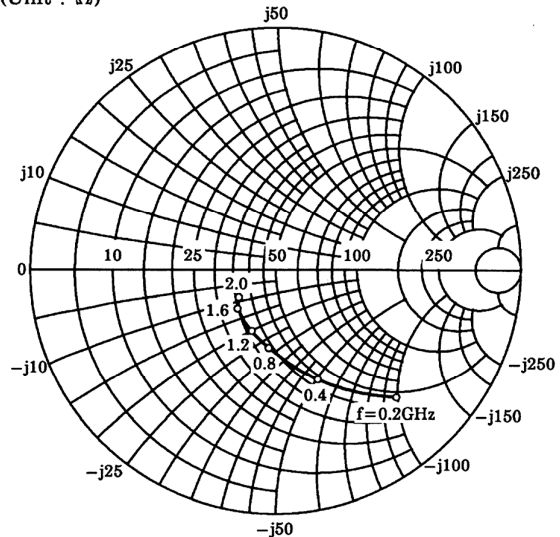
**S<sub>21e</sub>**  
 V<sub>CE</sub> = 10V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C



**S<sub>12e</sub>**  
 V<sub>CE</sub> = 10V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C



**S<sub>22e</sub>**  
 V<sub>CE</sub> = 10V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C  
 (Unit : Ω)



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