

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5089

VHF~UHF Band Low Noise Amplifier Applications

Unit: mm

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

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}	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 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).

S-MINI	
JEDEC	—
JEITA	SC-59
TOSHIBA	2-3F1A

Weight: 12mg (typ.)

Microwave Characteristics (Ta = 25°C)

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	—	

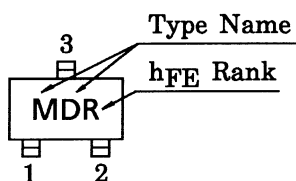
Electrical Characteristics (Ta = 25°C)

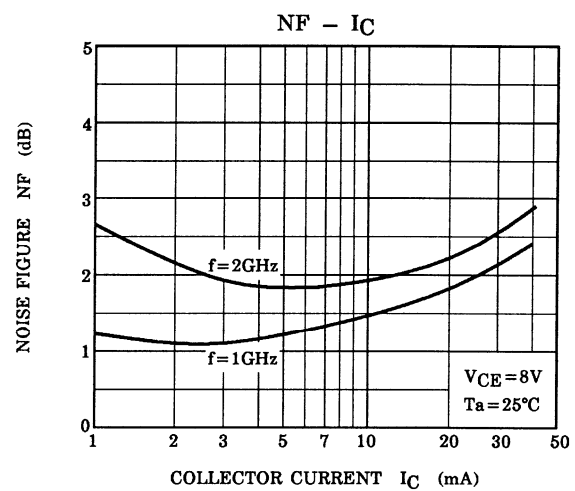
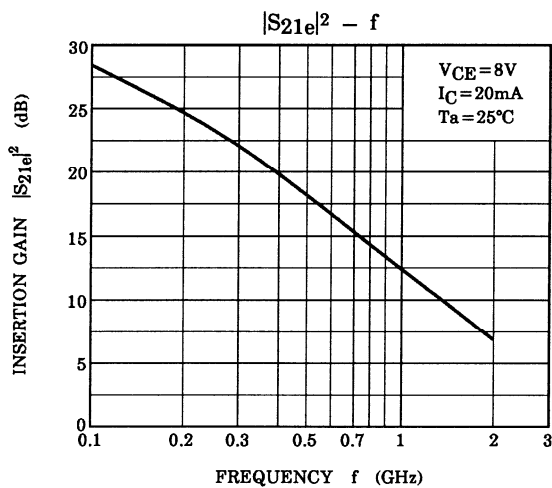
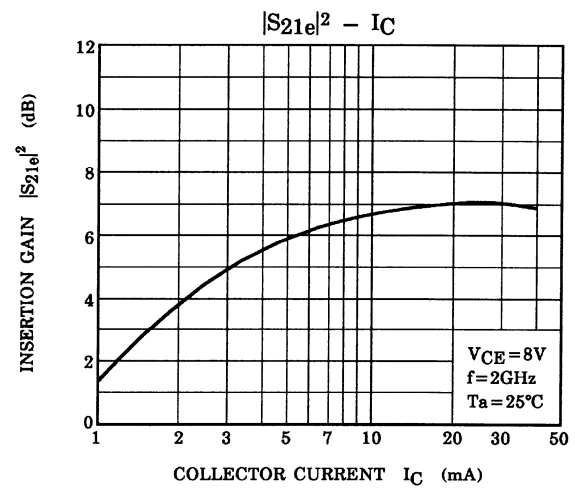
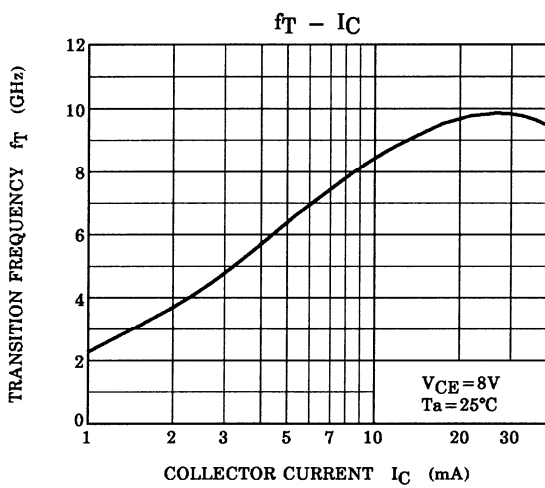
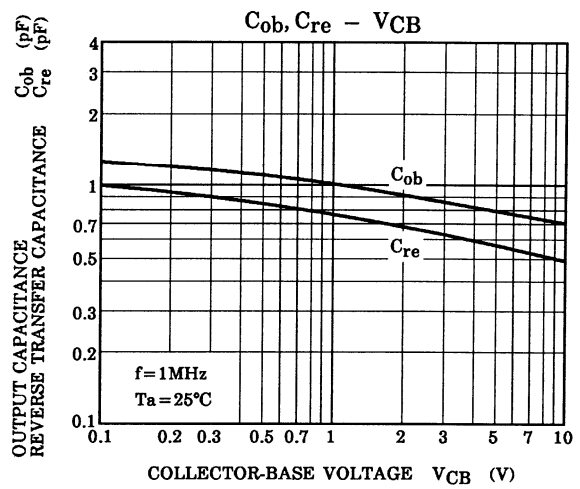
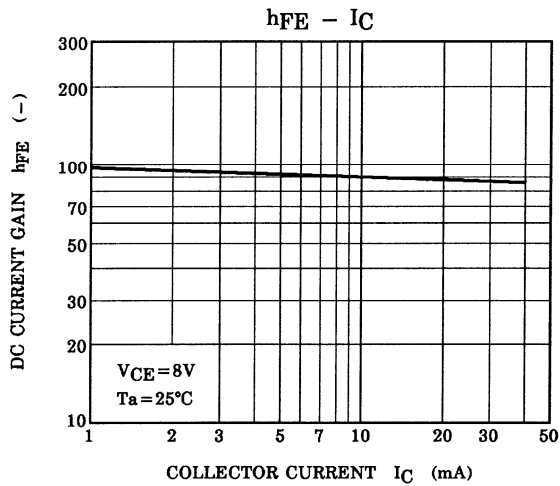
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	$V_{CB} = 10\text{ V}$, $I_E = 0$	—	—	1	μA
Emitter cut-off current	I_{EBO}	$V_{EB} = 1\text{ V}$, $I_C = 0$	—	—	1	μA
DC current gain	h_{FE} (Note 1)	$V_{CE} = 8\text{ V}$, $I_C = 20\text{ mA}$	50	—	160	
Output capacitance	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	1.0	pF

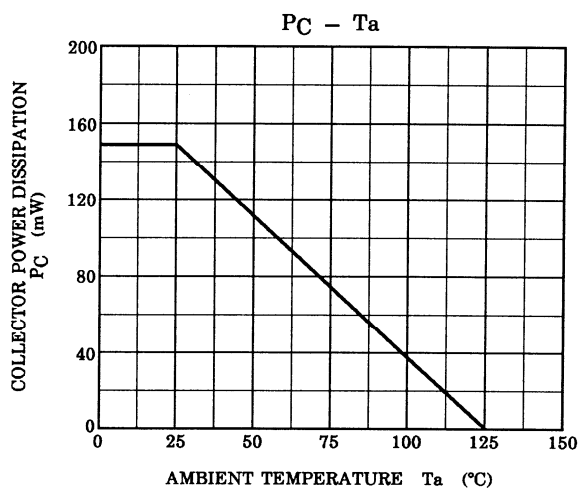
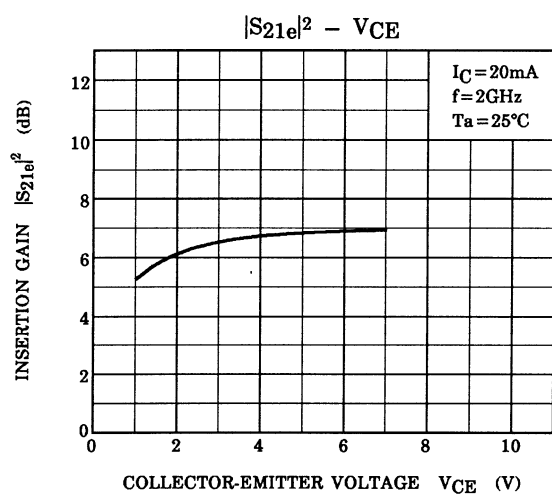
Note 1: h_{FE} classification R: 50 to 100, O: 80 to 160

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

Marking







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

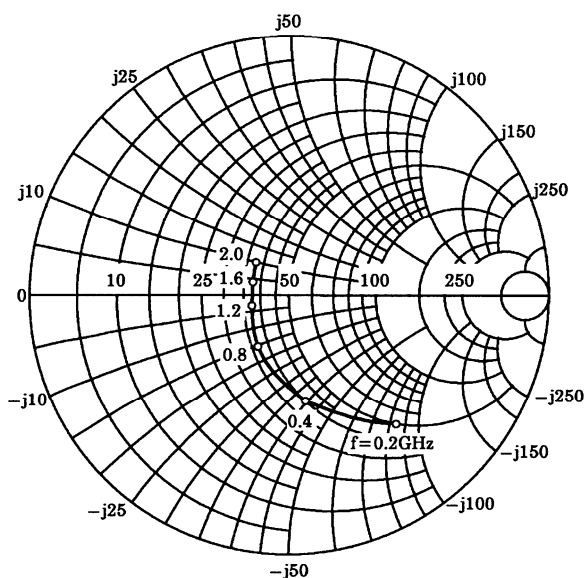
$V_{CE} = 8 \text{ V}$, $I_C = 5 \text{ mA}$

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

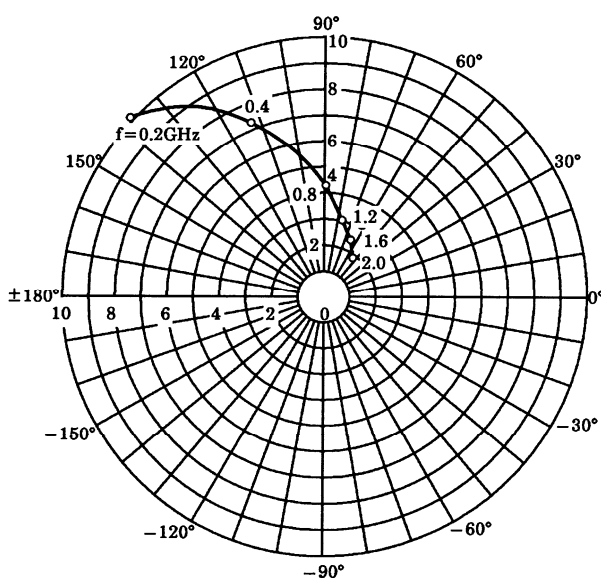
$V_{CE} = 8 \text{ V}$, $I_C = 20 \text{ mA}$

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

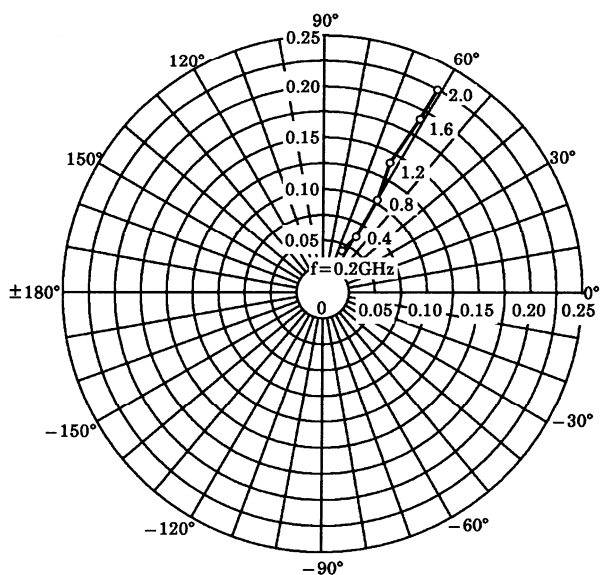
S_{11e}
 $V_{CE} = 8V$
 $I_C = 5mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



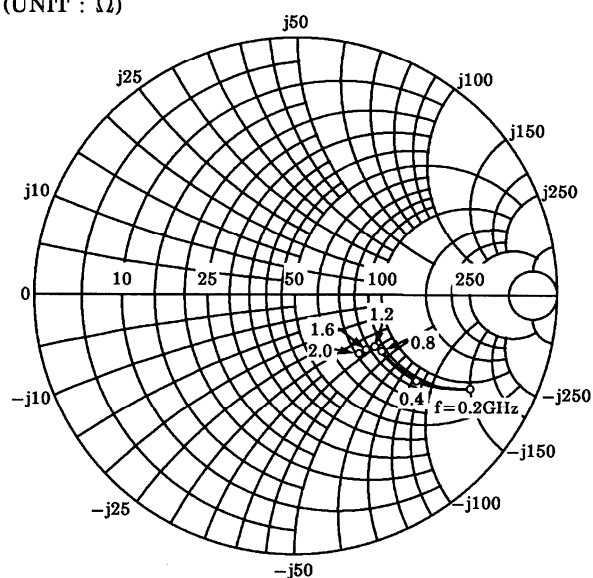
S_{21e}
 $V_{CE} = 8V$
 $I_C = 5mA$
 $T_a = 25^\circ C$



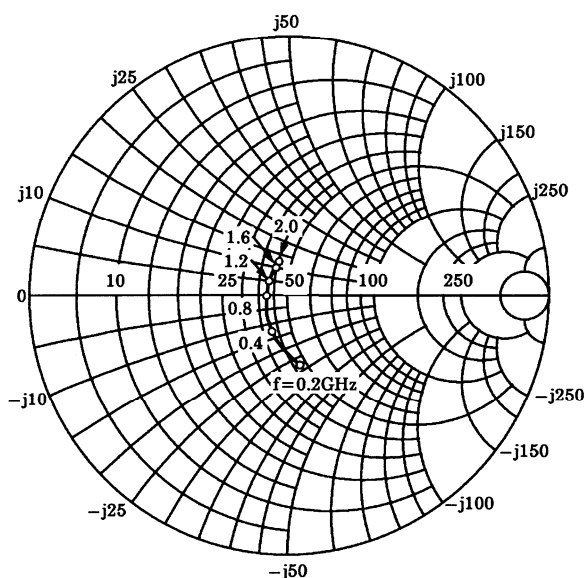
S_{12e}
 $V_{CE} = 8V$
 $I_C = 5mA$
 $T_a = 25^\circ C$



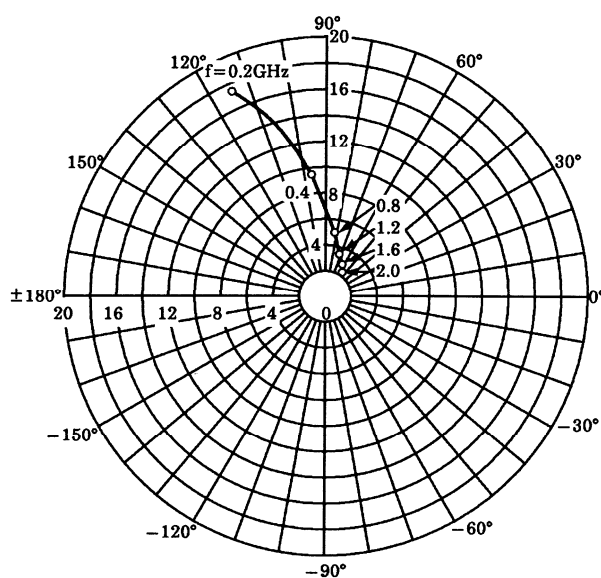
S_{22e}
 $V_{CE} = 8V$
 $I_C = 5mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



S_{11e}
 $V_{CE} = 8V$
 $I_C = 20mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



S_{21e}
 $V_{CE} = 8V$
 $I_C = 20mA$
 $T_a = 25^\circ C$



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