TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5089

VHF~UHF Band Low Noise Amplifier Applications

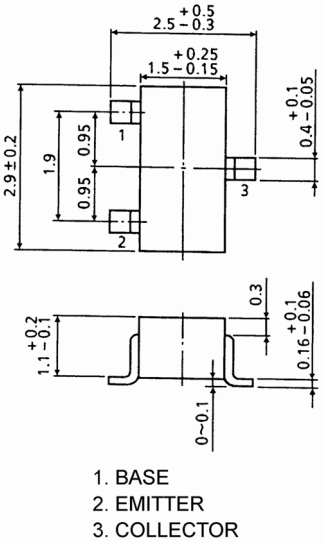
- Low noise figure, high gain.
- NF = 1.1dB, $|S_{21e}|^2$ = 13dB (f = 1 GHz)

Absolute Maximum Ratings (Ta = 25°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	°C
Storage temperature range	T_{stg}	−55 to 125	°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



1. BASE
2. EMITTER
3. COLLECTOR

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 V, I_C = 20 mA	7	10	—	GHz
Insertion gain	$\|S_{21e}\|^2$ (1)	V_{CE} = 8 V, I_C = 20 mA, f = 1 GHz	10	13	—	dB
	$\|S_{21e}\|^2$ (2)	V_{CE} = 8 V, I_C = 20 mA, f = 2 GHz	—	7	—	
Noise figure	NF (1)	V_{CE} = 8 V, I_C = 5 mA, f = 1 GHz	—	1.1	2.5	dB
	NF (2)	V_{CE} = 8 V, I_C = 5 mA, f = 2 GHz	—	1.7	—	

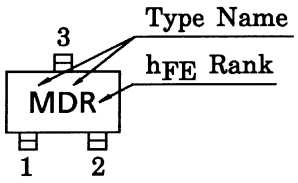
Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 10 V, I_E = 0	—	—	1	μA
Emitter cut-off current	I_{EBO}	V_{EB} = 1 V, I_C = 0	—	—	1	μA
DC current gain	h_{FE} (Note 1)	V_{CE} = 8 V, I_C = 20 mA	50	—	160	
Output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz (Note 2)	—	0.7	—	pF
Reverse transfer capacitance	C_{re}		—	0.5	1.0	pF

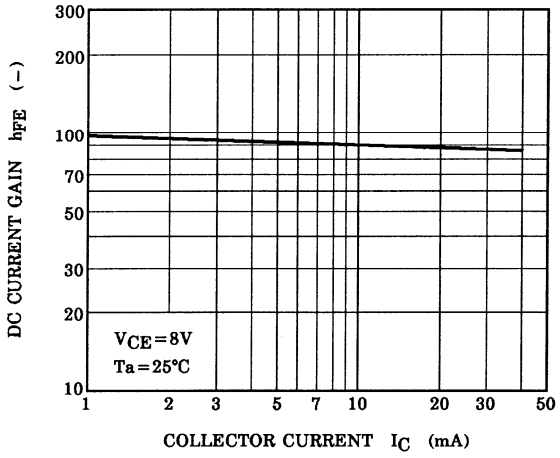
Note 1: h_{FE} classification R: 50 to 100, O: 80 to 160

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

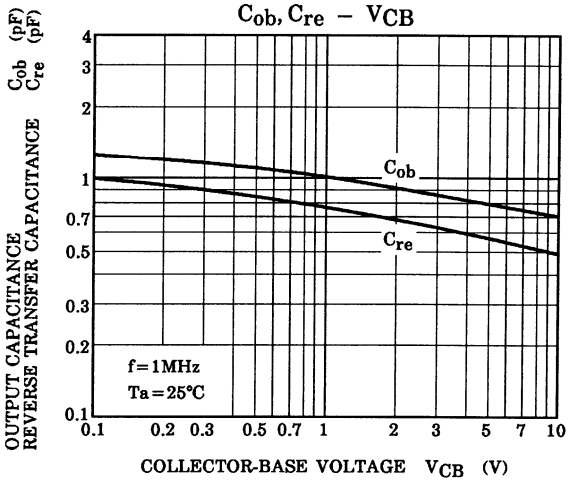
Marking



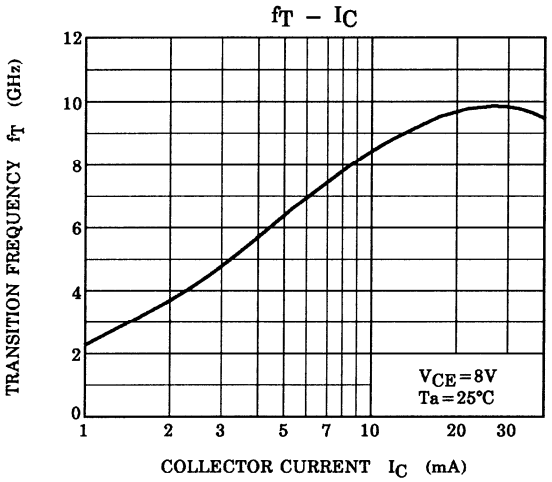
h_{FE} – I_C



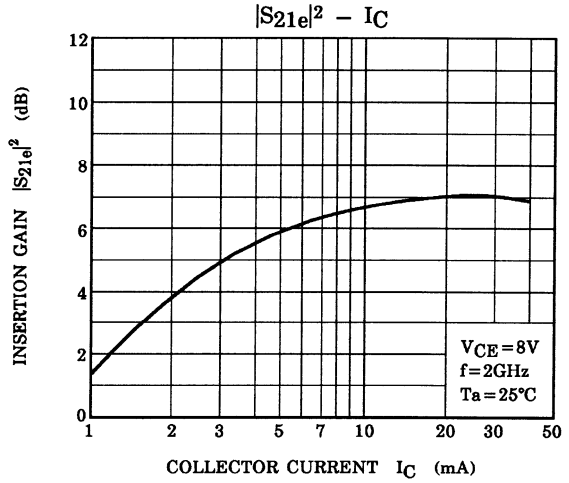
C_{ob}, C_{re} – V_{CB}



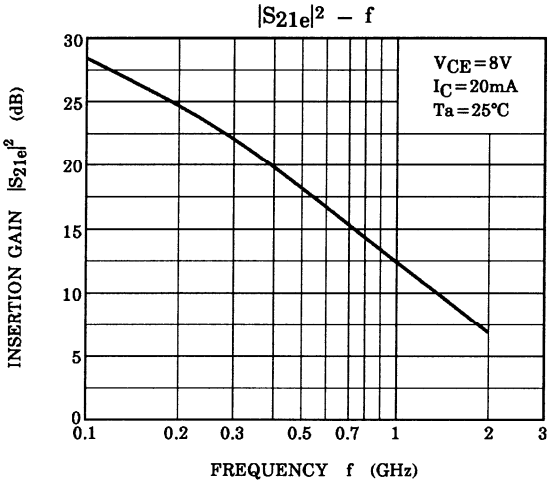
f_T – I_C



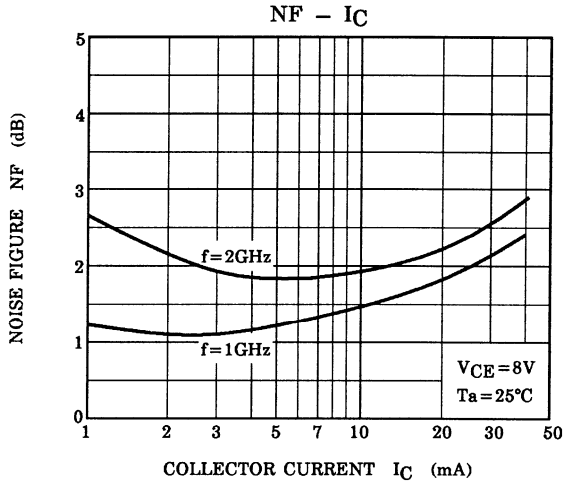
$|S_{21e}|^2$ – I_C

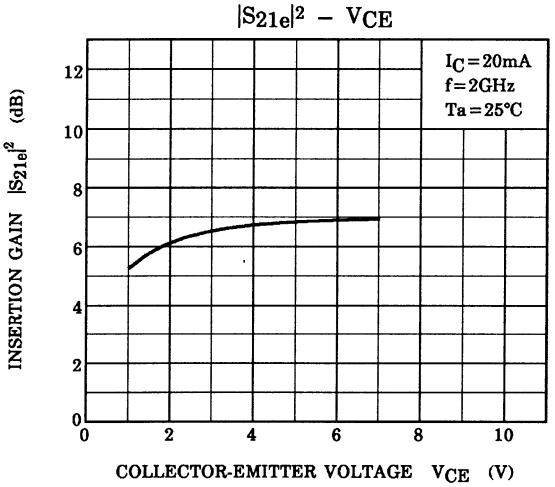


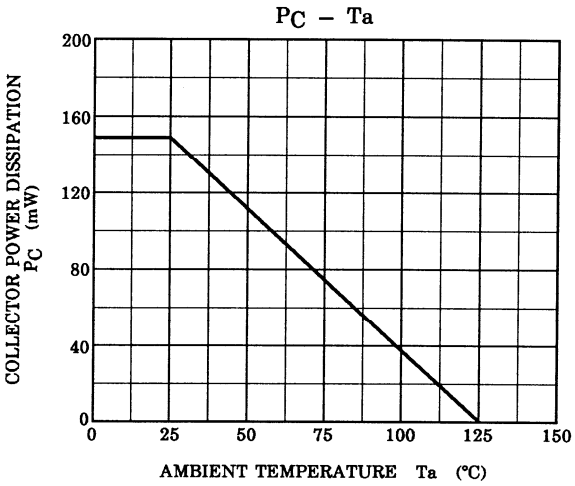
$|S_{21e}|^2$ – f



NF – I_C







S-Parameter Z_O = 50 Ω, Ta = 25°C

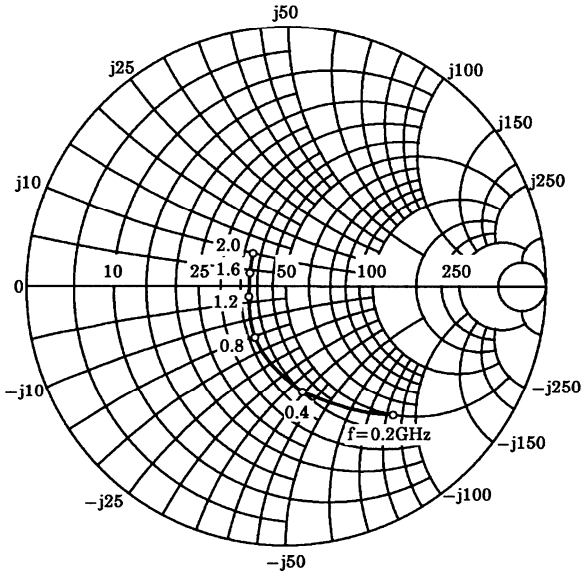
V_{CE} = 8 V, I_C = 5 mA

Frequency	S11		S21		S12		S22	
(MHz)	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 V, I_C = 20 mA

Frequency	S11		S21		S12		S22	
(MHz)	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
Ta = 25°C
(UNIT : Ω)



S_{21e}
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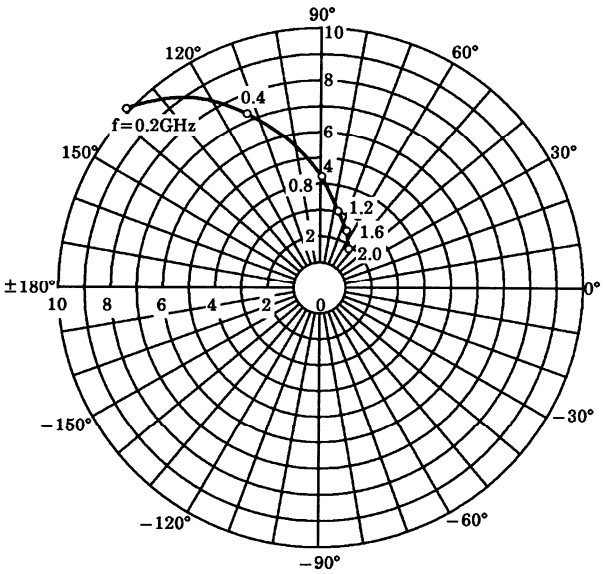

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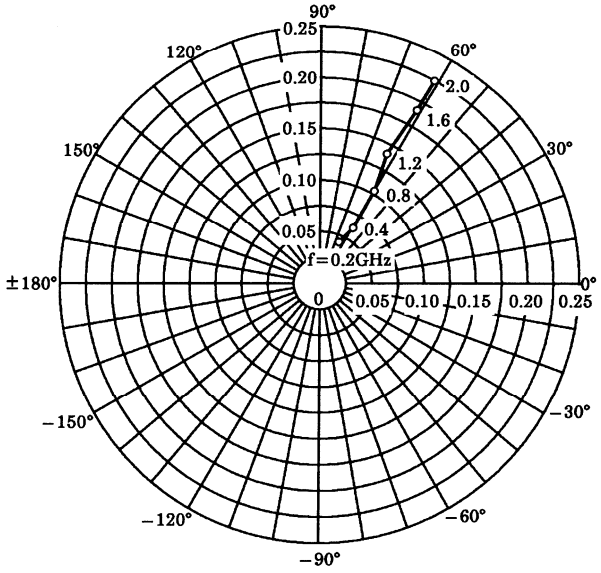

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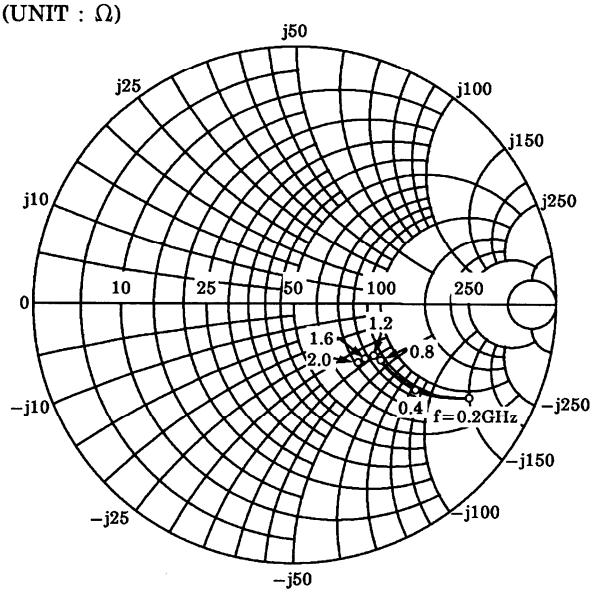
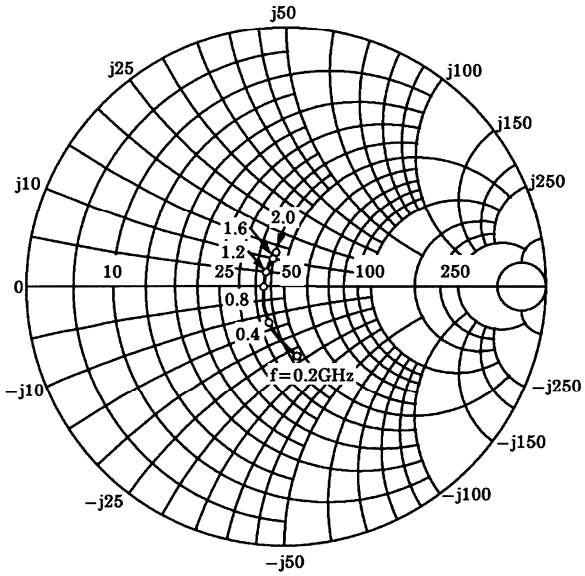


S_{11e}
V_{CE} = 8V
I_C = 20mA
Ta = 25°C
(UNIT : Ω)



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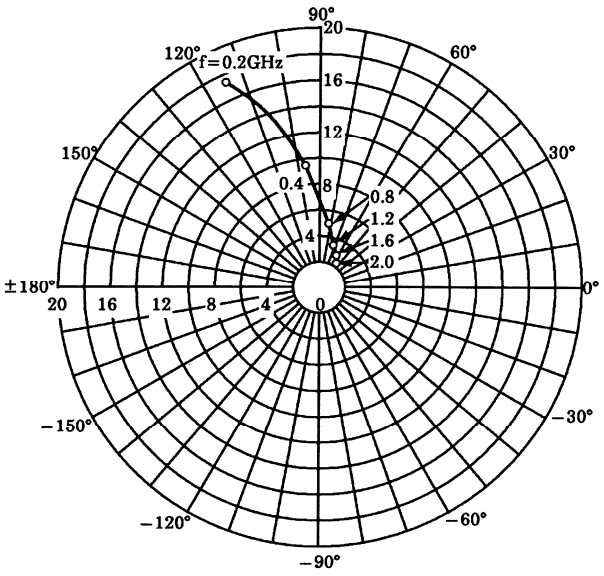

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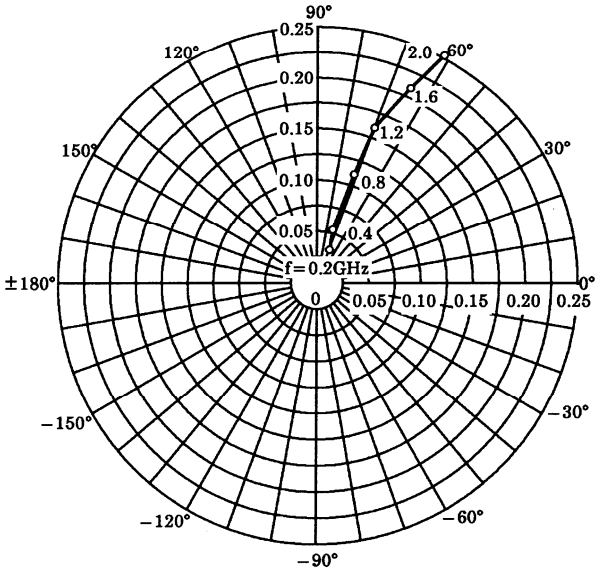

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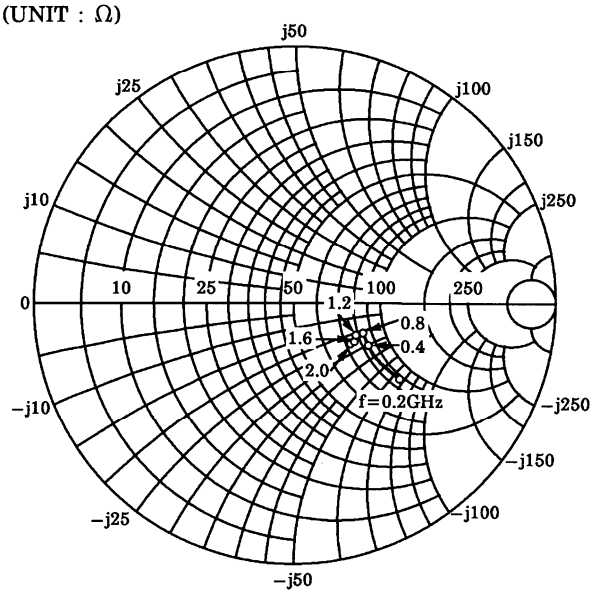

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