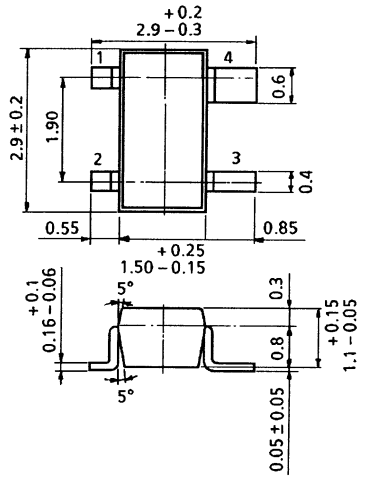
TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5087

VHF~UHF Band Low Noise Amplifier Applications

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

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3J1C

Weight: 0.012 g (typ.)

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

Microwave Characteristics (Ta = 25°C)

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

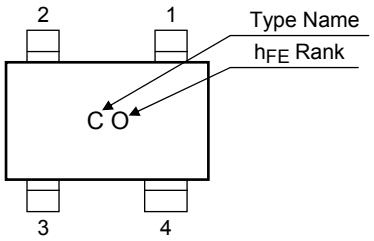
Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 10 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} = 10 V, I_C = 20 mA	80	—	240	
Output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz (Note 2)	—	1.1	1.6	pF
Reverse transfer capacitance	C_{re}		—	0.65	1.05	pF

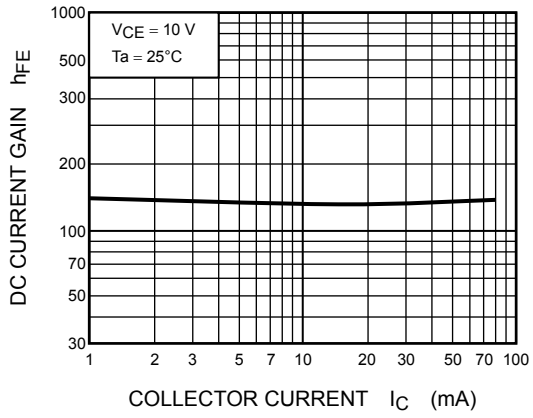
Note 1: h_{FE} classification O: 80~160, Y: 120~240

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

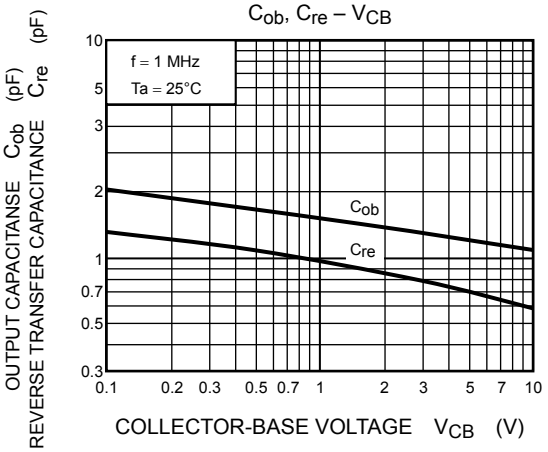
Marking



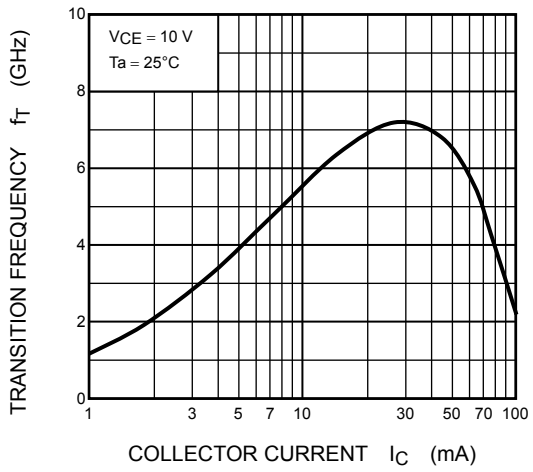
$h_{FE} - I_C$



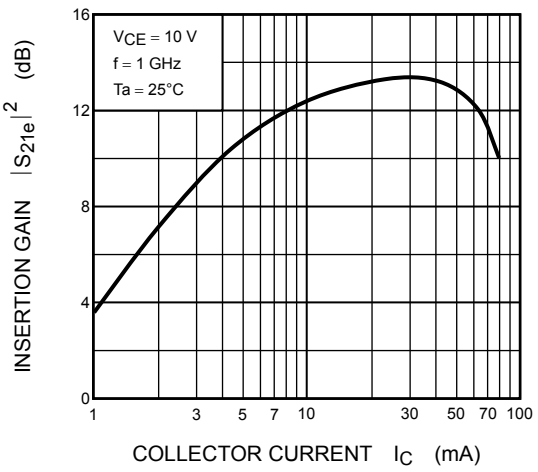
$C_{ob}, C_{re} - V_{CB}$



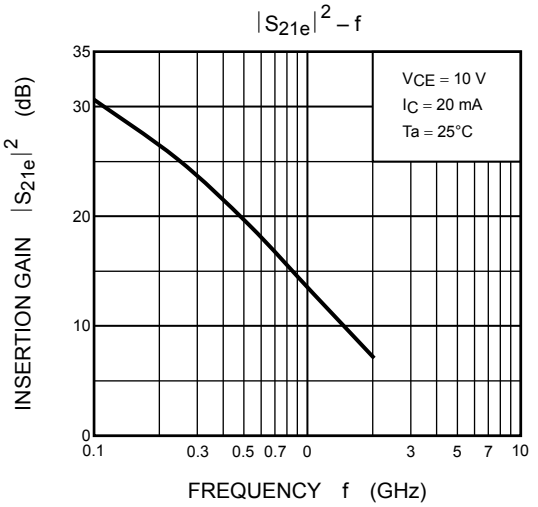
$f_T - I_C$



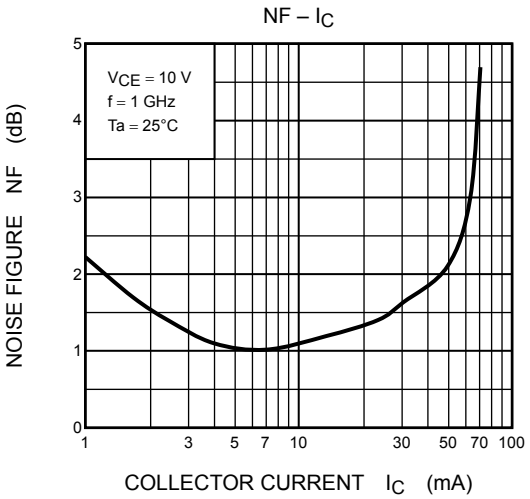
$|S_{21e}|^2 - I_C$

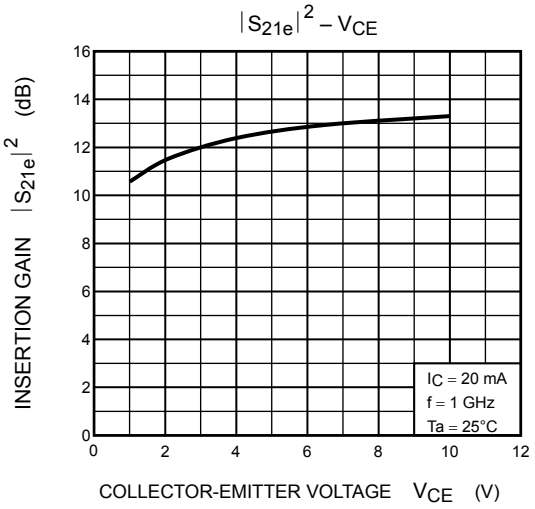


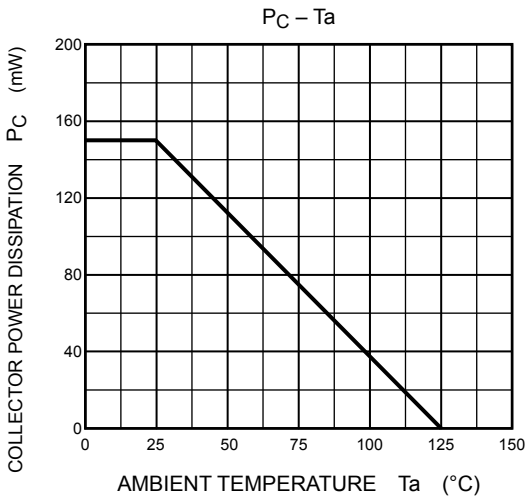
$|S_{21e}|^2 - f$



NF – I_C







S-Parameter $Z_O = 50\ \Omega$, Ta = 25°C

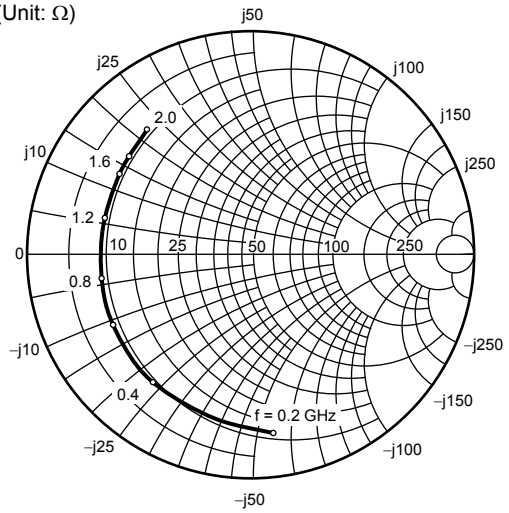
V_{CE} = 10 V, I_C = 5 mA

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

Frequency	S11		S21		S12		S22	
MHz	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_{11e}
V_{CE} = 10 V
I_C = 5 mA
Ta = 25°C
(Unit: Ω)



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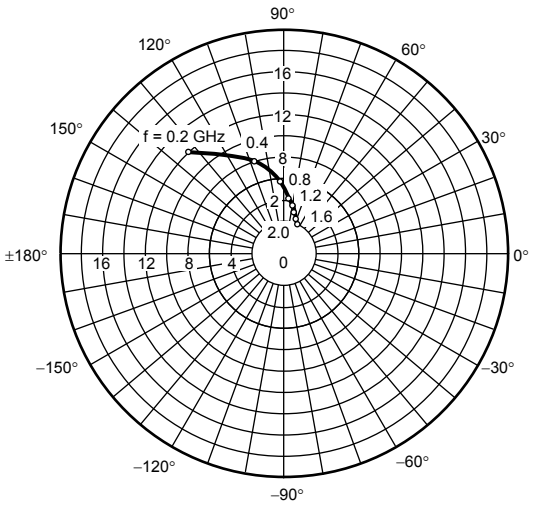

S_{12e}
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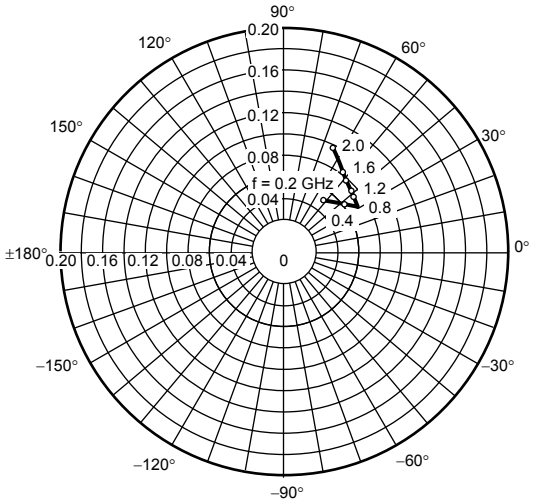

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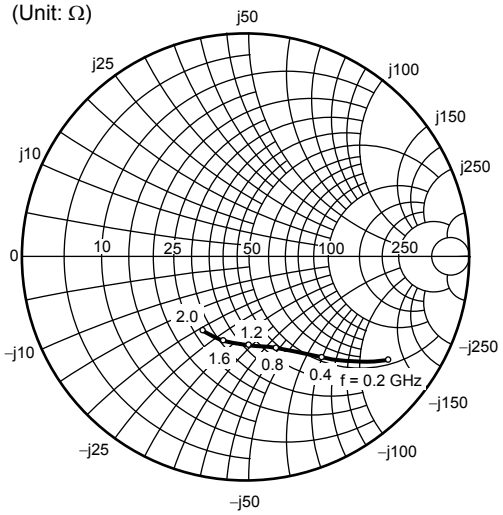

S_{11e}
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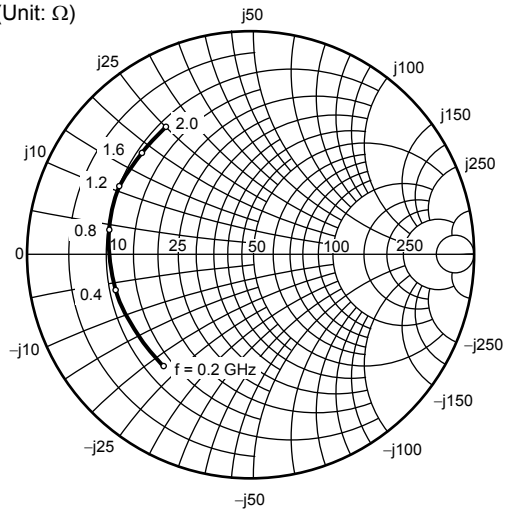

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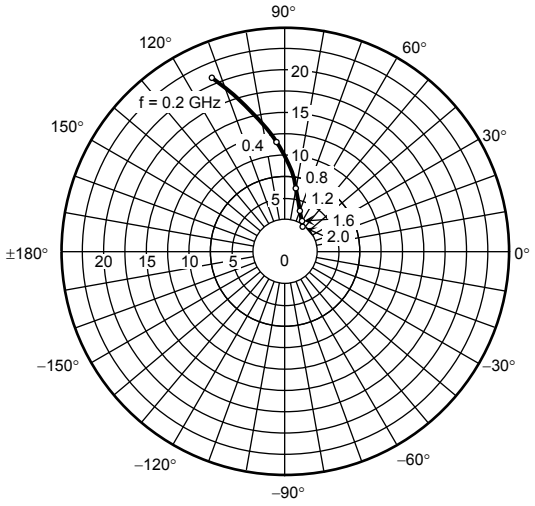

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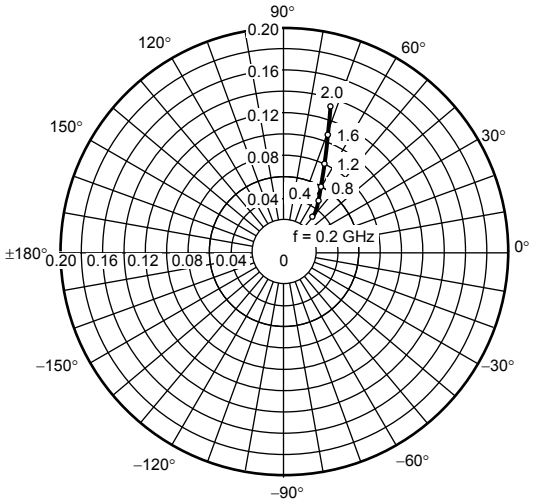

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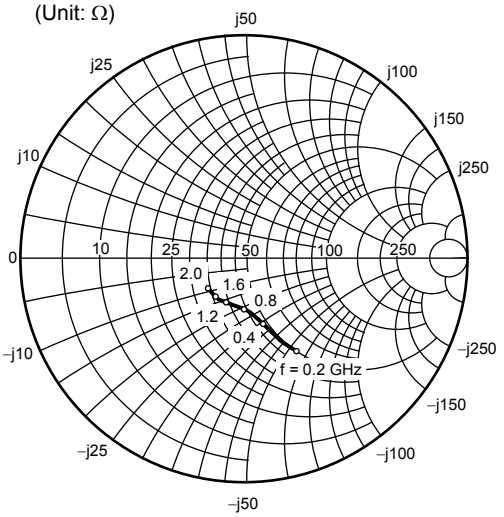

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20070701-EN GENERAL

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