TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5093

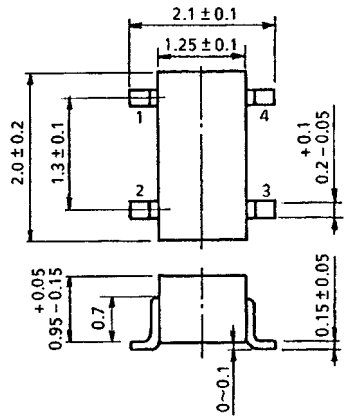
VHF~UHF Band Low Noise Amplifier Applications

- Low noise figure, high gain.
- NF = 1.8dB, $|S_{21e}|^2$ = 9.5dB (f = 2 GHz)

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	100	mW
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	−55~125	°C

Unit: mm



USQ

1, 3. EMITTER
2. BASE
4. COLLECTOR

JEDEC	—
JEITA	—
TOSHIBA	2-2K1A

Weight: 0.006 g (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	12	15	—	dB
	$\|S_{21e}\|^2$ (2)	V_{CE} = 8 V, I_C = 20 mA, f = 2 GHz	6.5	9.5	—	
Noise figure	NF (1)	V_{CE} = 8 V, I_C = 5 mA, f = 1 GHz	—	1.4	2.5	dB
	NF (2)	V_{CE} = 8 V, I_C = 5 mA, f = 2 GHz	—	1.8	3	

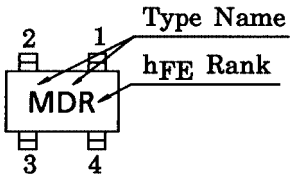
Electrical Characteristics (Ta = 25°C)

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} = 15 V, I_E = 0, f = 1 MHz (Note 2)	—	0.65	1.05	pF
Reverse transfer capacitance	C_{re}		—	0.45	0.95	pF

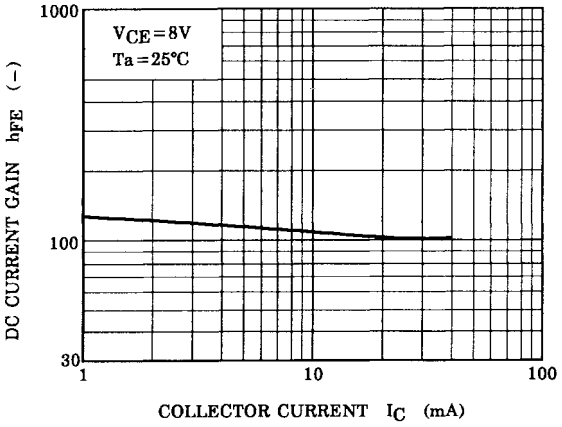
Note 1: h_{FE} classification R: 50~100, O: 80~160

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

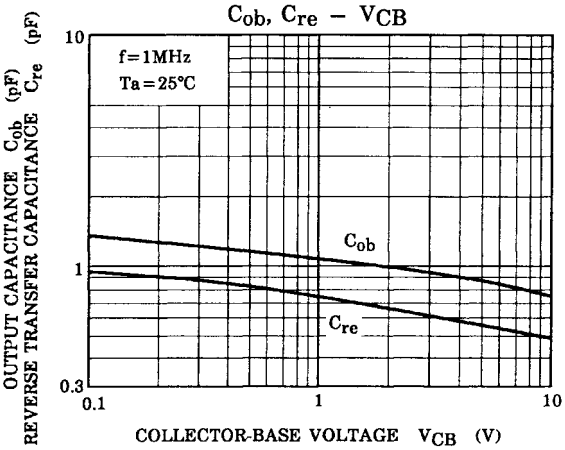
Marking



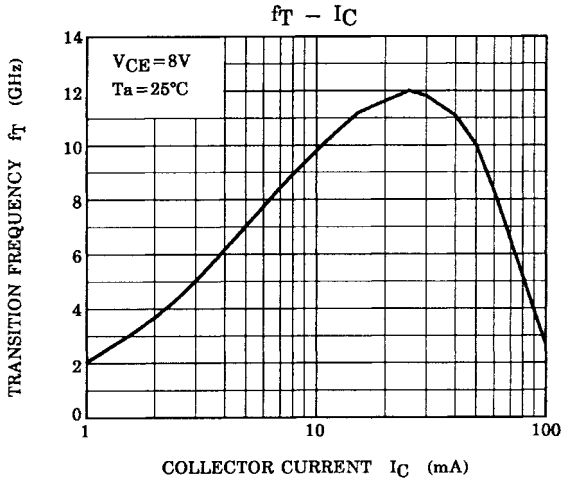
h_{FE} – I_C



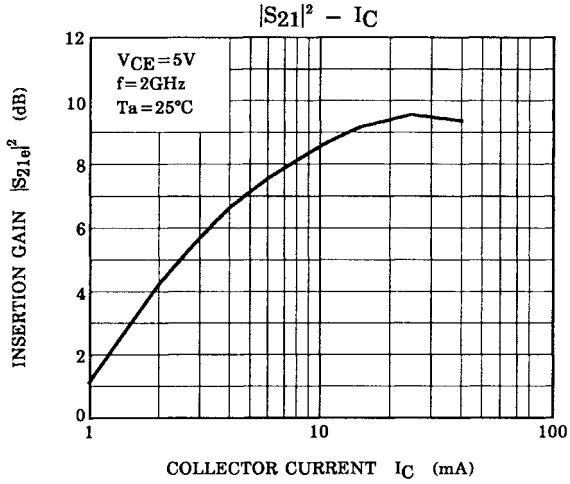
C_{ob}, C_{re} – V_{CB}



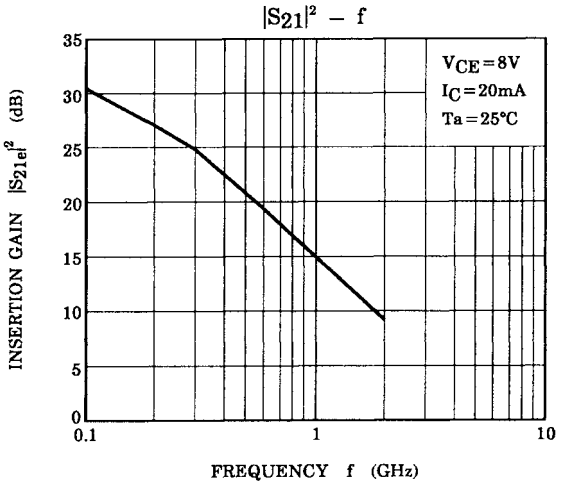
f_T – I_C



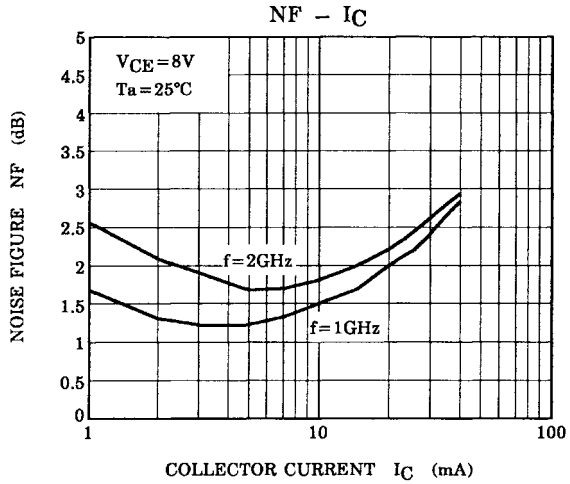
$|S_{21}|^2$ – I_C

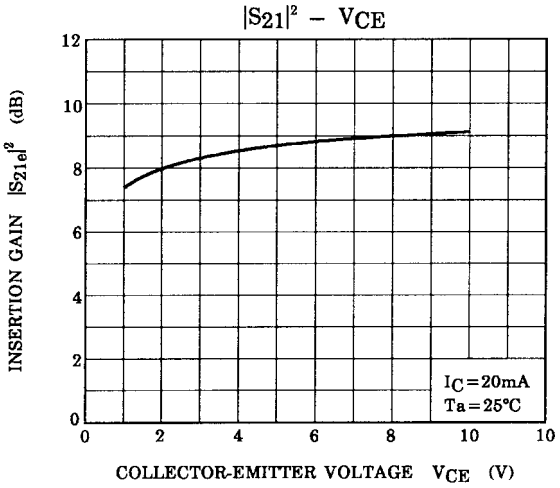


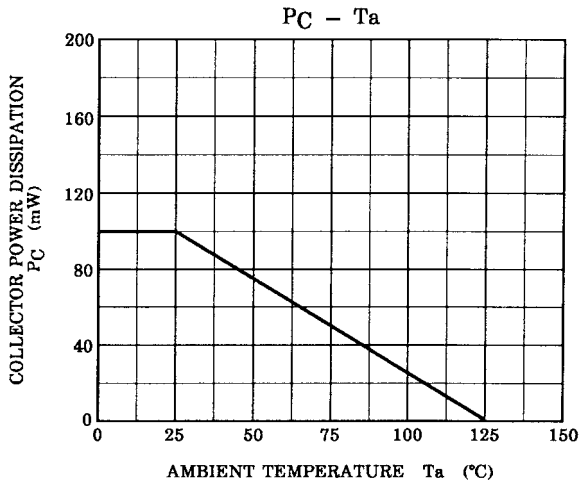
$|S_{21}|^2$ – f



NF – I_C







S-Parameter Z_O = 50 Ω, Ta = 25°C

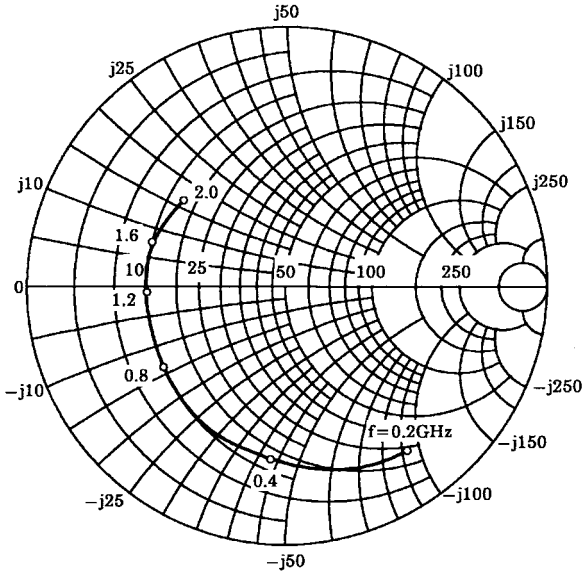
V_{CE} = 8 V, I_C = 5 mA

Frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.801	−54.4	12.628	145.4	0.047	63.2	0.864	−32.2
400	0.696	−95.6	9.664	121.9	0.072	48.8	0.675	−54.2
600	0.617	−124.7	7.307	106.2	0.083	42.3	0.543	−68.4
800	0.585	−146.3	5.779	95.1	0.090	39.3	0.456	−79.6
1000	0.554	−163.0	4.674	86.8	0.095	39.5	0.400	−88.6
1200	0.545	−176.5	3.902	80.0	0.099	40.4	0.357	−96.8
1400	0.529	171.3	3.350	75.0	0.103	42.5	0.323	−104.5
1600	0.529	161.1	2.929	70.0	0.108	44.8	0.299	−111.0
1800	0.527	150.4	2.612	66.1	0.116	47.1	0.277	−116.5
2000	0.513	141.0	2.366	62.1	0.122	49.6	0.258	−120.3

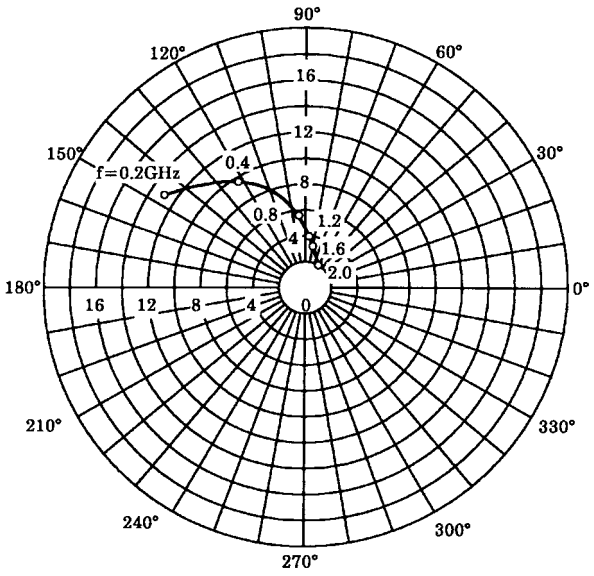
V_{CE} = 8 V, I_C = 20 mA

Frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.556	−95.4	23.034	126.0	0.032	55.7	0.629	−53.5
400	0.521	−137.0	13.888	105.1	0.045	52.0	0.407	−75.8
600	0.505	−160.0	9.597	94.2	0.054	54.0	0.311	−89.3
800	0.505	−174.7	7.272	86.8	0.064	56.4	0.263	−101.3
1000	0.508	172.6	5.797	81.0	0.075	59.0	0.233	−112.0
1200	0.519	163.1	4.800	76.5	0.085	60.4	0.208	−122.9
1400	0.518	153.4	4.119	72.8	0.095	62.0	0.189	−132.7
1600	0.525	144.3	3.603	69.1	0.106	63.2	0.172	−141.7
1800	0.532	135.6	3.231	66.4	0.119	63.8	0.153	−149.3
2000	0.523	125.9	2.952	62.8	0.131	64.6	0.131	−153.9

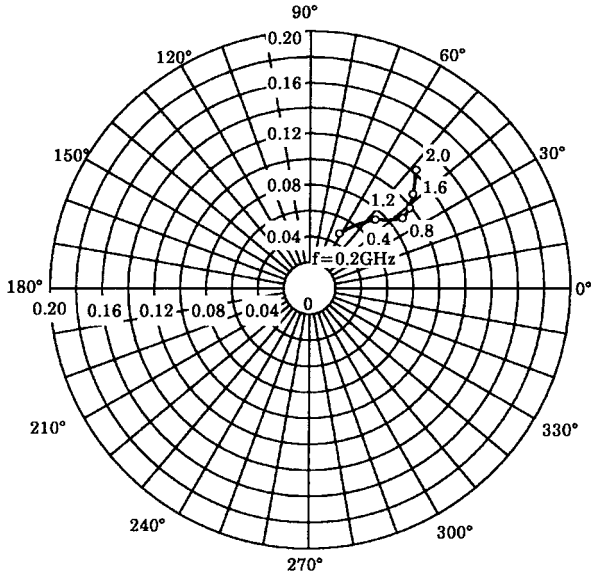
S_{11e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C
(Unit : Ω)



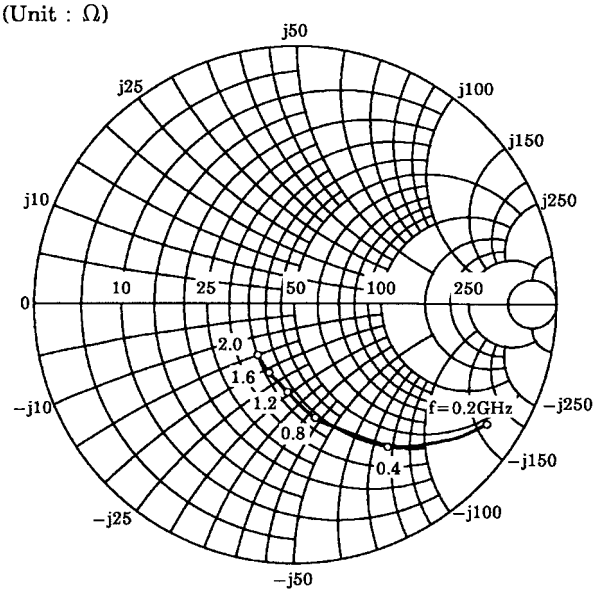
S_{21e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C



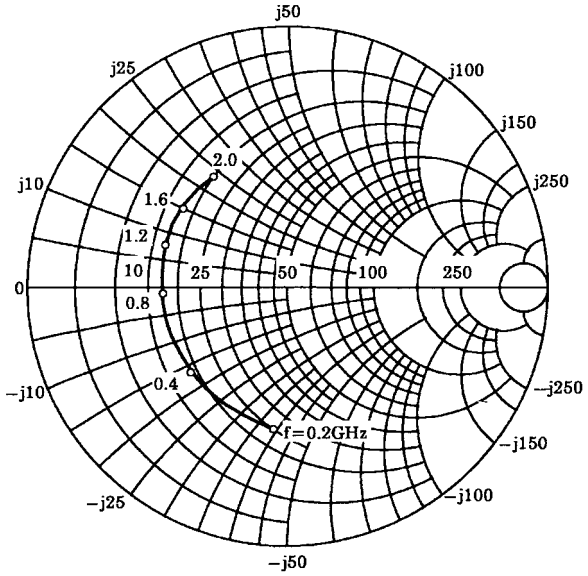
S_{12e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C



S_{22e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C
(Unit : Ω)



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



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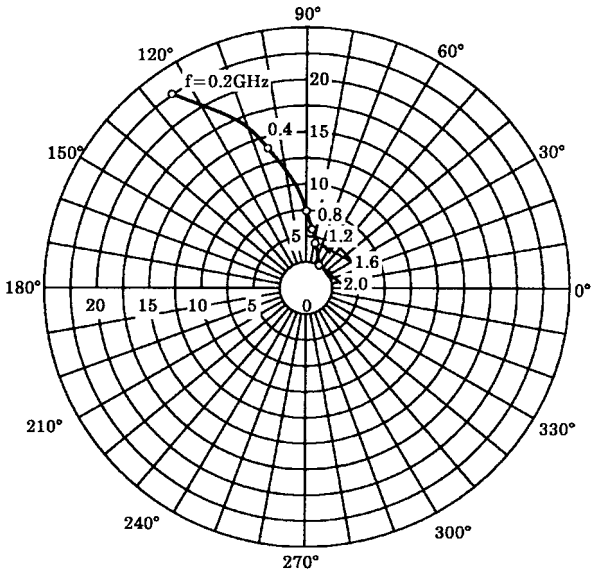

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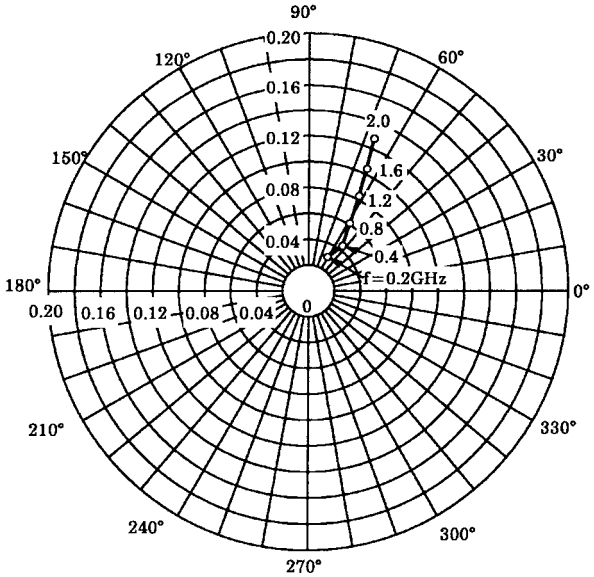

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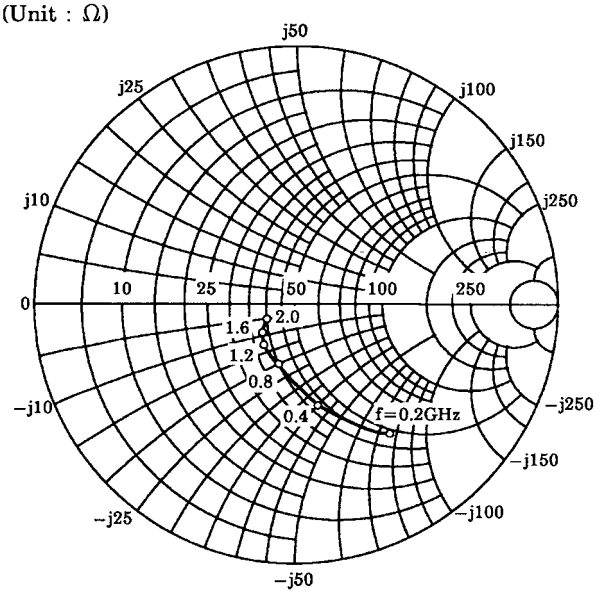

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