

TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL PLANAR TYPE

# 2SC5093

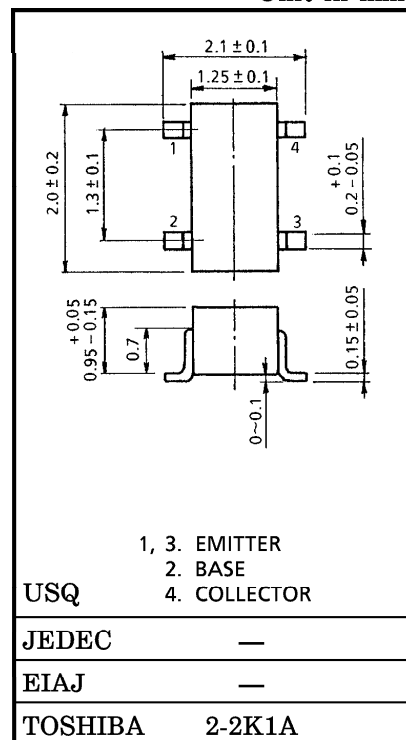
VHF~UHF BAND LOW NOISE AMPLIFIER APPLICATIONS

Unit in mm

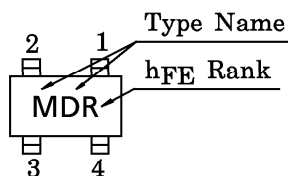
- Low Noise Figure, High Gain.
- $NF=1.8dB$ ,  $|S_{21e}|^2=9.5dB$  ( $f=2GHz$ )

MAXIMUM RATINGS ( $T_a = 25^\circ C$ )

CHARACTERISTIC	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	$^\circ C$
Storage Temperature Range	$T_{stg}$	-55~125	$^\circ C$



MARKING



MICROWAVE CHARACTERISTICS ( $T_a = 25^\circ C$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Transition Frequency	$f_T$	$V_{CE}=8V, I_C=20mA$	7	10	—	GHz
Insertion Gain	$ S_{21e} ^2 (1)$	$V_{CE}=8V, I_C=20mA, f=1GHz$	12	15	—	dB
	$ S_{21e} ^2 (2)$	$V_{CE}=8V, I_C=20mA, f=2GHz$	6.5	9.5	—	
Noise Figure	NF (1)	$V_{CE}=8V, I_C=5mA, f=1GHz$	—	1.4	2.5	dB
	NF (2)	$V_{CE}=8V, I_C=5mA, f=2GHz$	—	1.8	3	

ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ C$ )

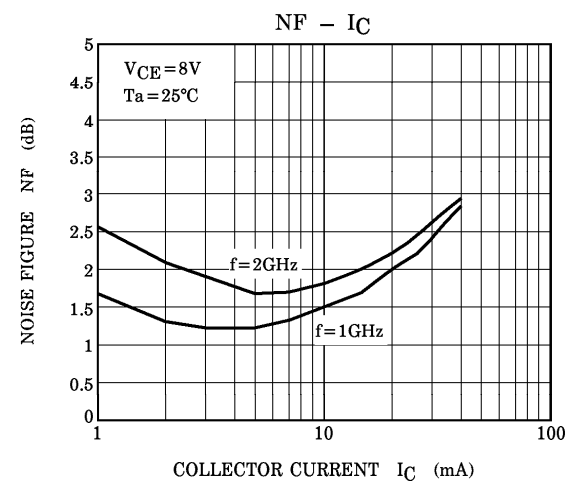
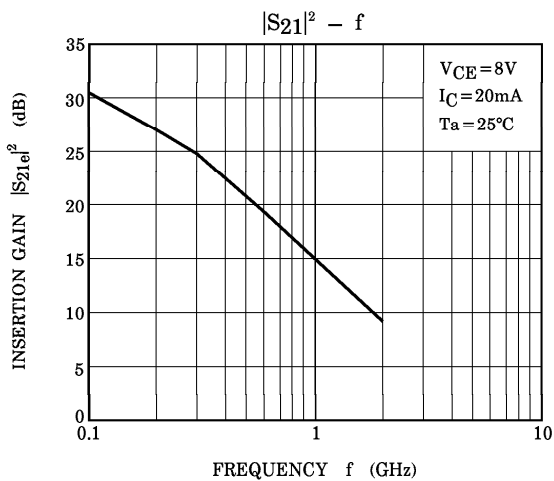
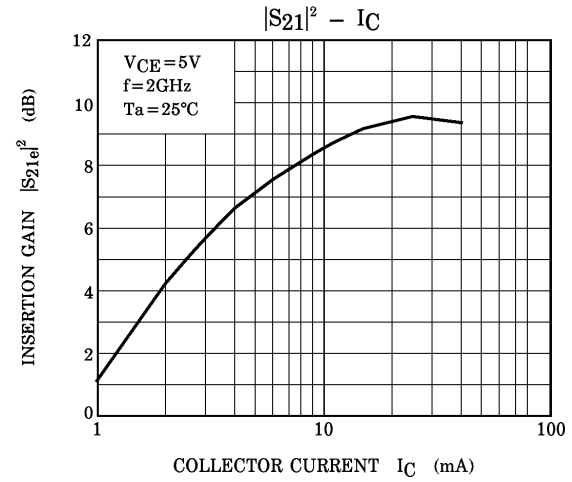
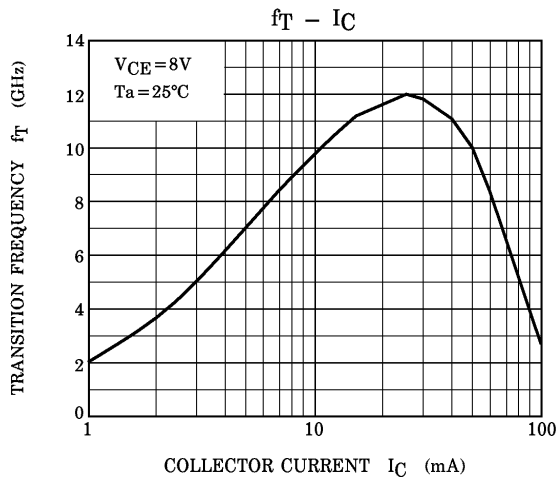
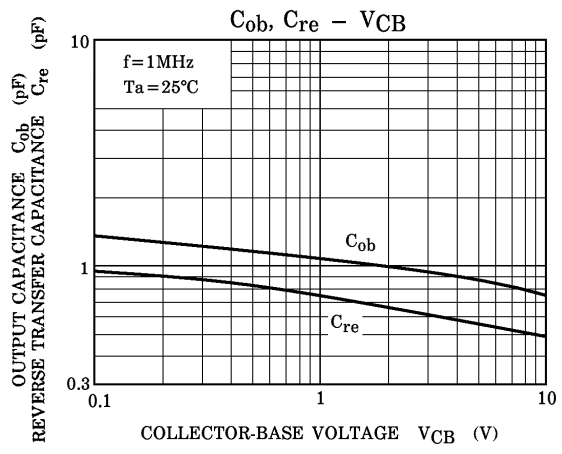
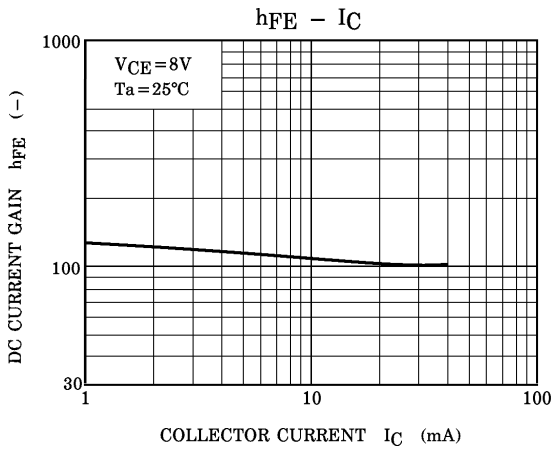
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	$I_{CBO}$	$V_{CB}=10V, I_E=0$	—	—	1	$\mu A$
Emitter Cut-off Current	$I_{EBO}$	$V_{EB}=1V, I_C=0$	—	—	1	$\mu A$
DC Current Gain	$h_{FE}$ (Note 1)	$V_{CE}=8V, I_C=20mA$	50	—	160	—
Output Capacitance	$C_{ob}$	$V_{CB}=15V, I_E=0, f=1MHz$	—	0.65	1.05	pF
Reverse Transfer Capacitance	$C_{re}$		(Note 2)	—	0.45	0.95

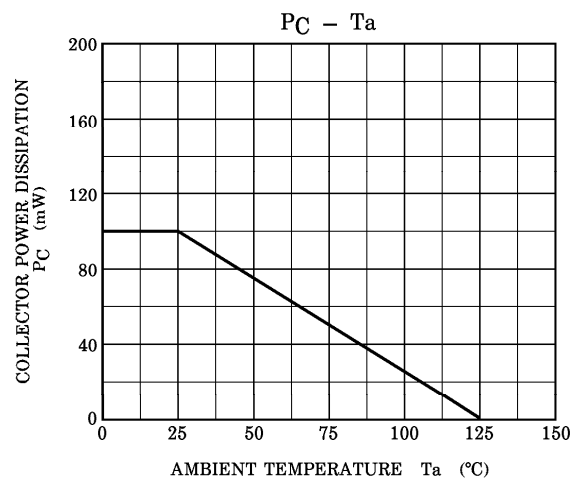
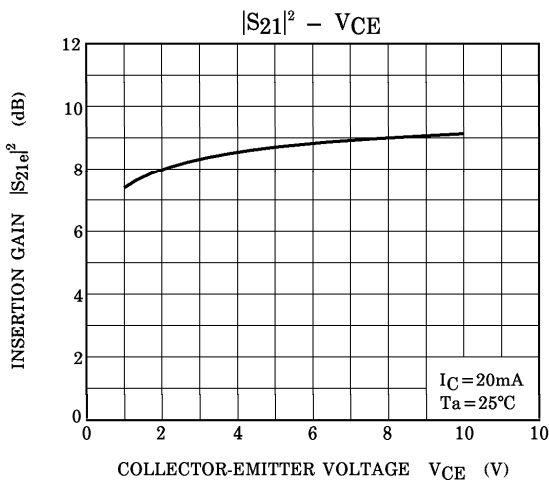
(Note 1)  $h_{FE}$  Classification R : 50~100, O : 80~160

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

961001EAA2

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.





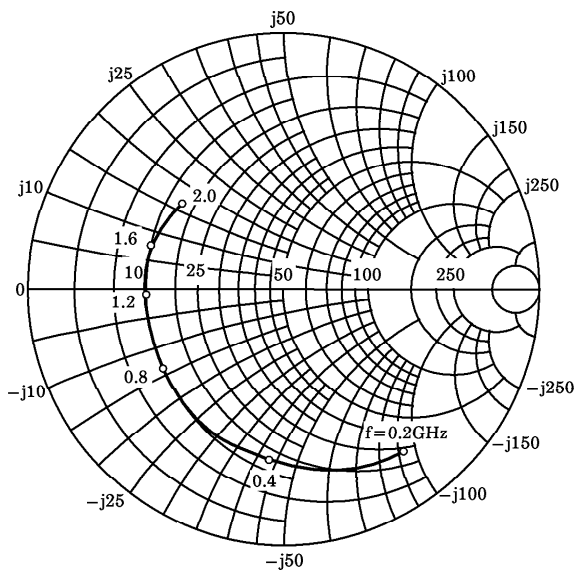
S-Parameter  $Z_0 = 50\Omega$ ,  $T_a = 25^\circ\text{C}$   
 $V_{CE} = 8\text{V}$ ,  $I_C = 5\text{mA}$

frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.801	-54.4	12.628	145.4	0.047	63.2	0.864	-32.8
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

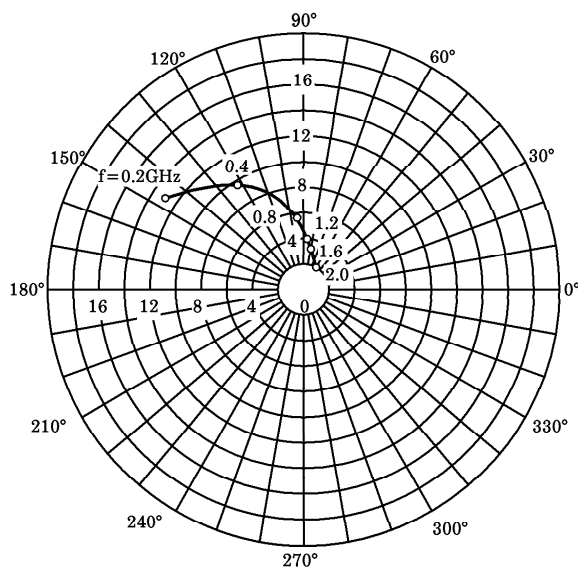
$V_{CE} = 8\text{V}$ ,  $I_C = 20\text{mA}$

frequency (MHz)	S11		S21		S12		S22	
	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

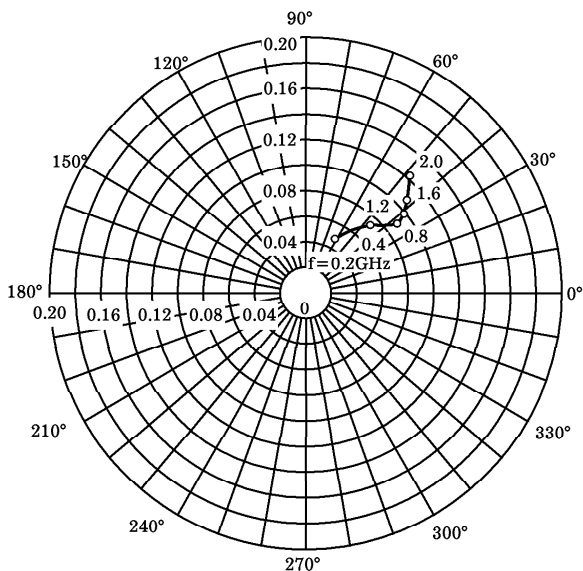
**S<sub>11e</sub>**  
 V<sub>CE</sub>=8V  
 I<sub>C</sub>=5mA  
 T<sub>a</sub>=25°C  
 (Unit : Ω)



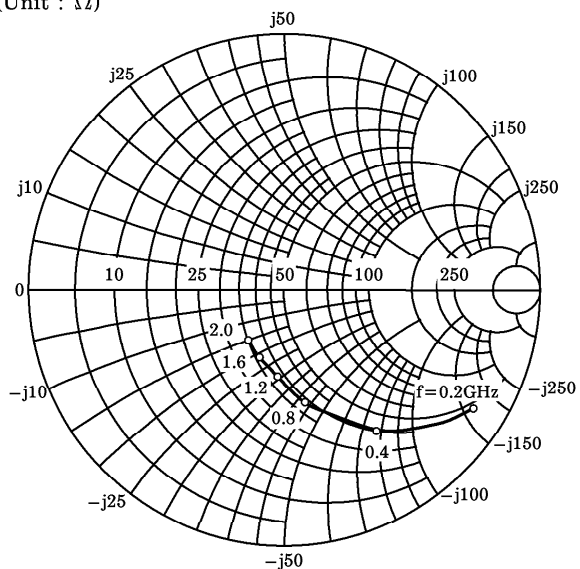
**S<sub>21e</sub>**  
 V<sub>CE</sub>=8V  
 I<sub>C</sub>=5mA  
 T<sub>a</sub>=25°C



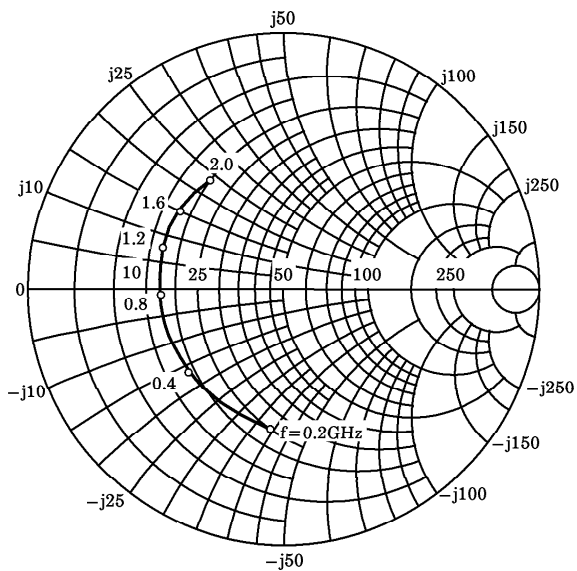
**S<sub>12e</sub>**  
 V<sub>CE</sub>=8V  
 I<sub>C</sub>=5mA  
 T<sub>a</sub>=25°C



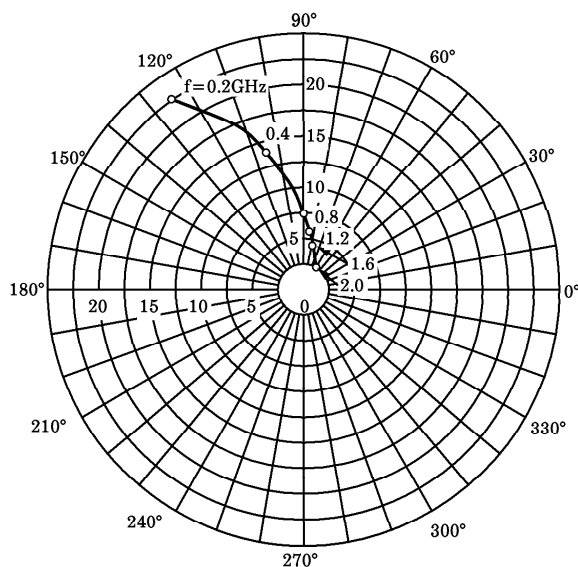
**S<sub>22e</sub>**  
 V<sub>CE</sub>=8V  
 I<sub>C</sub>=5mA  
 T<sub>a</sub>=25°C  
 (Unit : Ω)



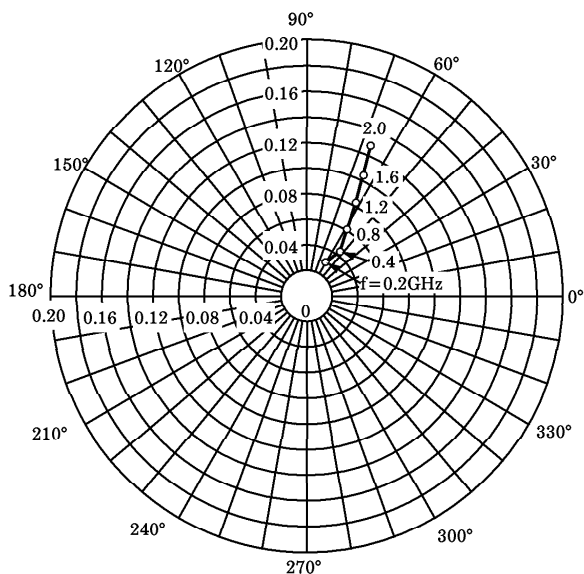
**S<sub>11e</sub>**  
 V<sub>CE</sub> = 8V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C  
 (Unit : Ω)



**S<sub>21e</sub>**  
 V<sub>CE</sub> = 8V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C



**S<sub>12e</sub>**  
 V<sub>CE</sub> = 8V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C



**S<sub>22e</sub>**  
 V<sub>CE</sub> = 8V  
 I<sub>C</sub> = 20mA  
 T<sub>a</sub> = 25°C  
 (Unit : Ω)

