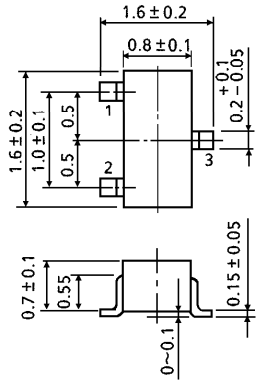
TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL PLANAR TYPE

2SC5091

VHF~UHF BAND LOW NOISE AMPLIFIER APPLICATIONS

Unit in mm

- Low Noise Figure, High Gain.
- NF = 1.1dB, $|S_{21e}|^2$ = 7dB (f = 1GHz)



1. BASE
2. EMITTER
3. COLLECTOR

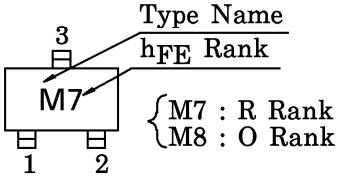
SSM	
JEDEC	—
EIAJ	—
TOSHIBA	2-2H1A

Weight : 2.4mg

MAXIMUM RATINGS (Ta = 25°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	°C
Storage Temperature Range	T_{stg}	−55~125	°C

MARKING



MICROWAVE CHARACTERISTICS (Ta = 25°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	10	13	—	dB
	$\|S_{21e}\|^2$ (2)	V_{CE} = 8V, I_C = 20mA, f = 2GHz	—	7	—	
Noise Figure	NF (1)	V_{CE} = 8V, I_C = 5mA, f = 1GHz	—	1.1	2.5	dB
	NF (2)	V_{CE} = 8V, I_C = 5mA, f = 2GHz	—	1.7	—	

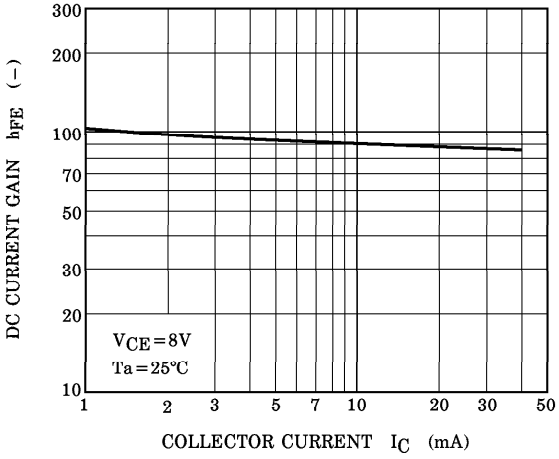
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 10V, I_E = 0	—	—	1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1V, I_C = 0	—	—	1	μA
DC Current Gain	h_{FE} (Note 1)	V_{CE} = 8V, I_C = 20mA	50	—	160	—
Output Capacitance	C_{ob}	V_{CB} = 10V, I_E = 0, f = 1MHz	—	0.7	—	pF
Reverse Transfer Capacitance	C_{re}	(Note 2)	—	0.5	0.95	pF

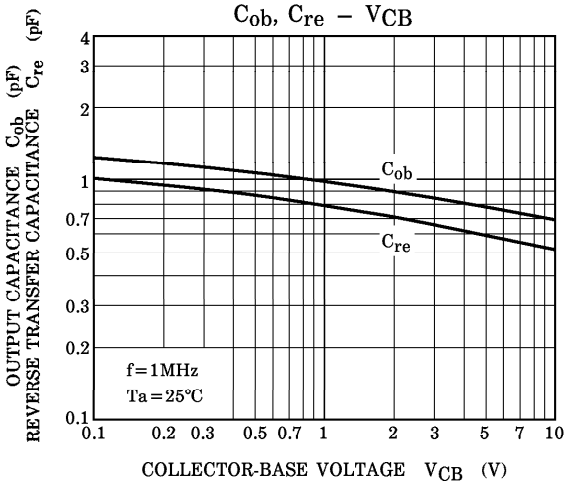
(Note 1) h_{FE} Classification R : 50~100, O : 80~160

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

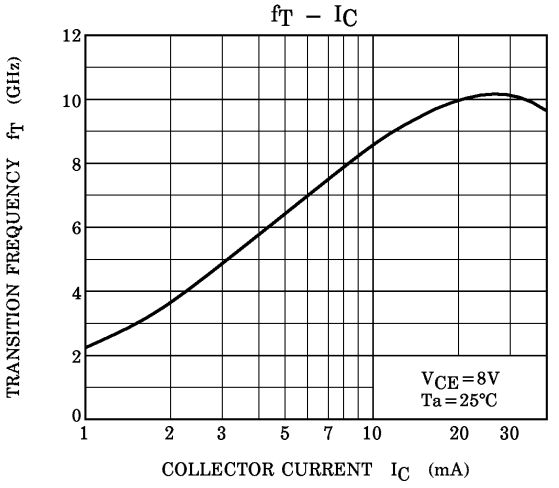
h_{FE} – I_C



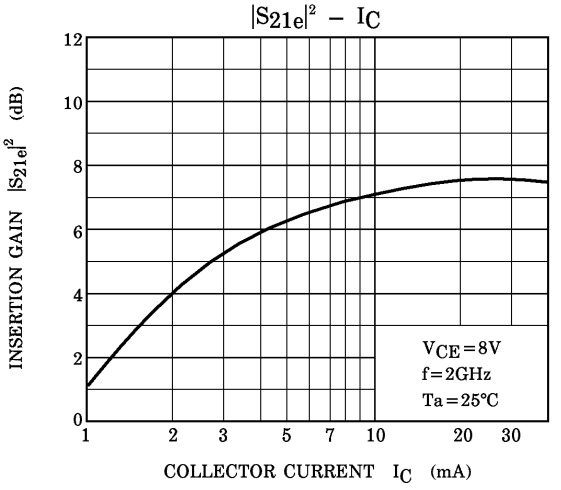
C_{ob}, C_{re} – V_{CB}



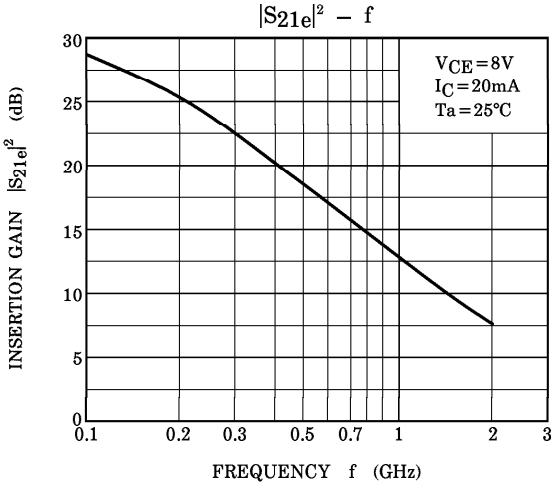
f_T – I_C



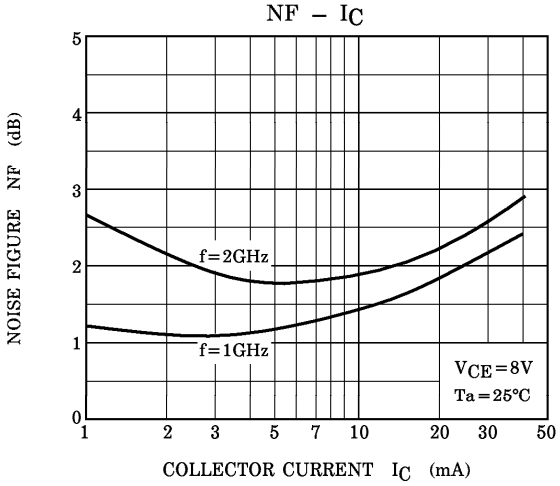
$|S_{21e}|^2$ – I_C

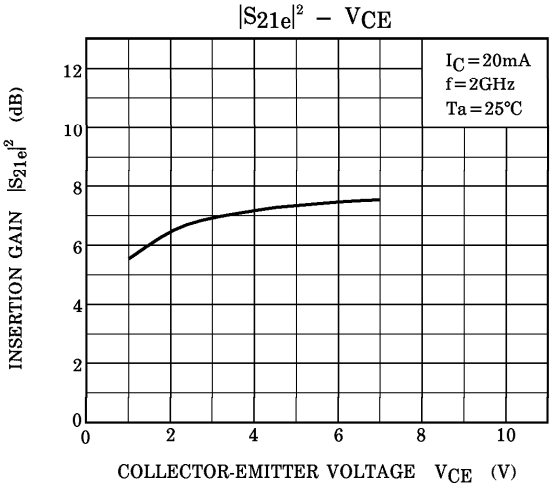


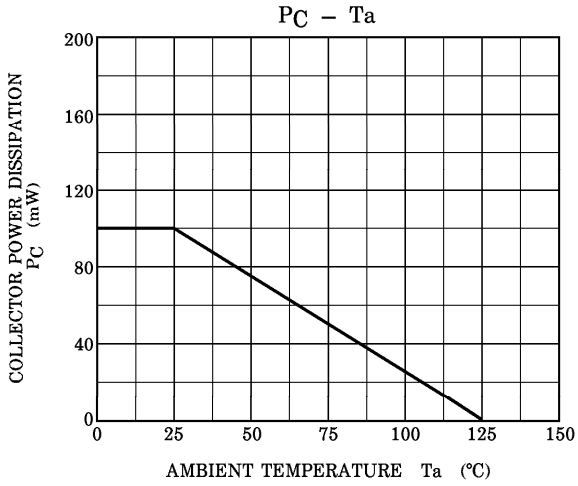
$|S_{21e}|^2$ – f



NF – I_C







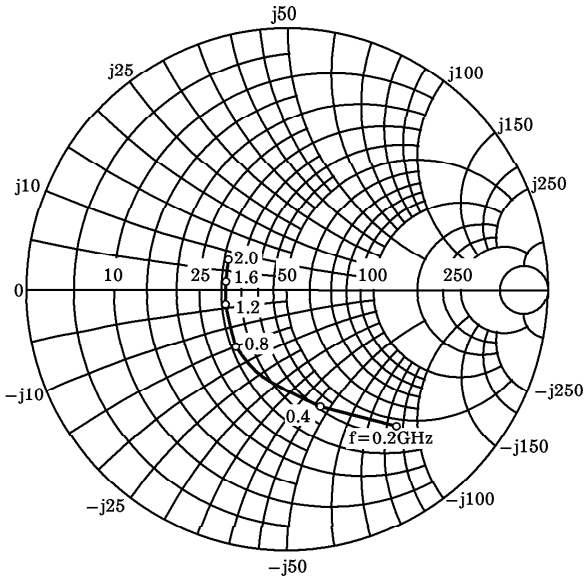
S-Parameter $Z_O = 50\Omega$, Ta = 25°C
V_{CE} = 8V, I_C = 5mA

frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.683	−50.1	10.186	138.3	0.049	62.0	0.773	−30.0
400	0.462	−86.9	7.472	114.6	0.071	54.3	0.556	−39.6
600	0.343	−113.1	5.618	100.9	0.086	53.8	0.448	−41.7
800	0.282	−133.6	4.407	91.7	0.101	55.3	0.392	−41.6
1000	0.249	−151.0	3.663	84.7	0.115	57.2	0.360	−41.7
1200	0.236	−166.6	3.128	78.7	0.131	58.9	0.339	−41.7
1400	0.233	179.7	2.759	73.1	0.150	60.1	0.330	−42.8
1600	0.234	168.3	2.457	68.2	0.168	60.0	0.319	−45.0
1800	0.238	158.6	2.224	63.4	0.185	60.0	0.311	−47.9
2000	0.251	149.6	2.038	59.4	0.203	60.4	0.302	−50.2

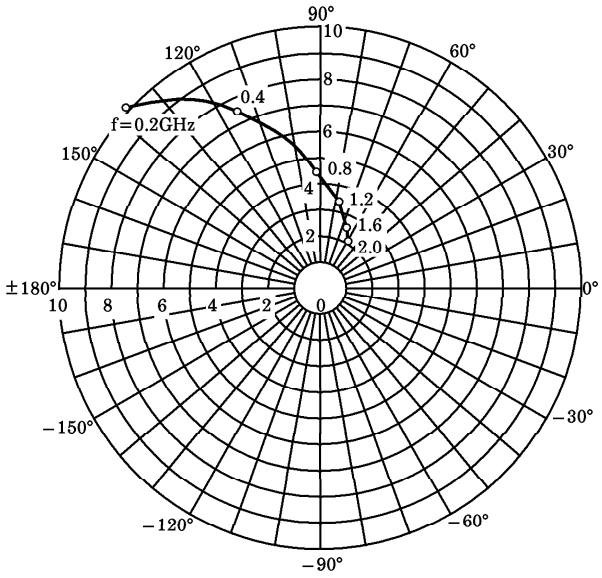
V_{CE} = 8V, I_C = 20mA

frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.319	−91.9	18.338	116.7	0.033	65.3	0.494	−43.5
400	0.213	−134.2	10.303	99.2	0.054	68.9	0.312	−42.4
600	0.185	−160.0	7.111	90.3	0.076	70.8	0.258	−37.6
800	0.176	−178.2	5.415	84.3	0.098	71.2	0.236	−34.3
1000	0.174	167.8	4.400	79.2	0.120	71.1	0.228	−32.0
1200	0.178	156.8	3.712	74.8	0.143	70.3	0.226	−31.5
1400	0.186	147.5	3.236	70.3	0.168	68.7	0.226	−32.8
1600	0.194	139.7	2.874	66.3	0.190	66.6	0.223	−35.9
1800	0.199	133.7	2.583	62.6	0.211	64.9	0.216	−39.0
2000	0.215	127.8	2.369	58.8	0.232	63.5	0.211	−41.9

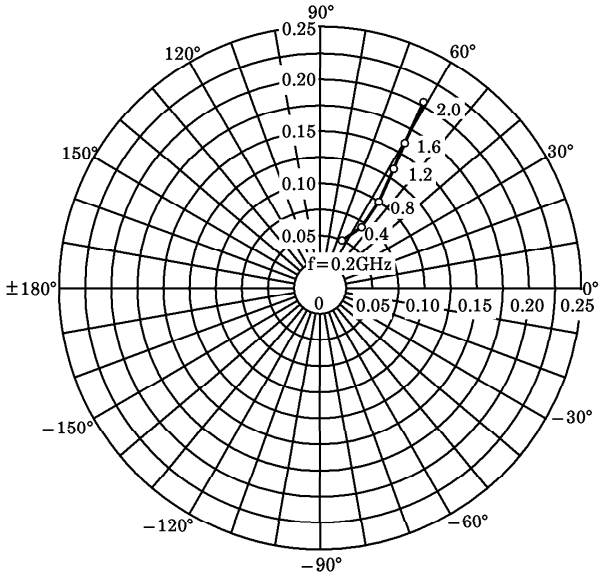
S_{11e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C
(UNIT : Ω)



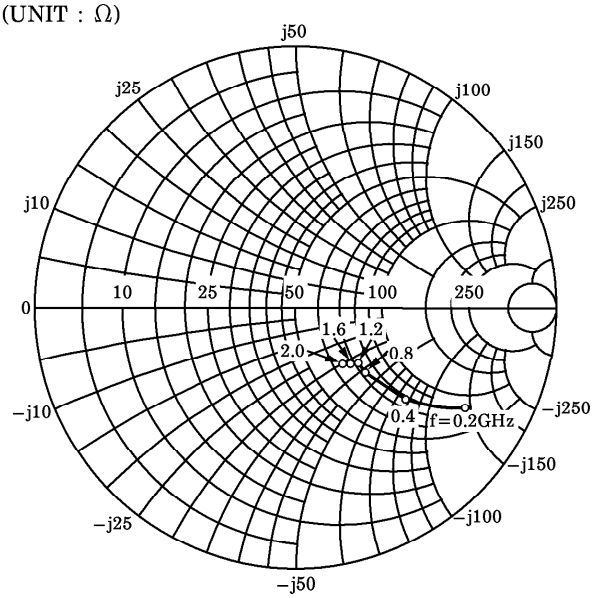
S_{21e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C



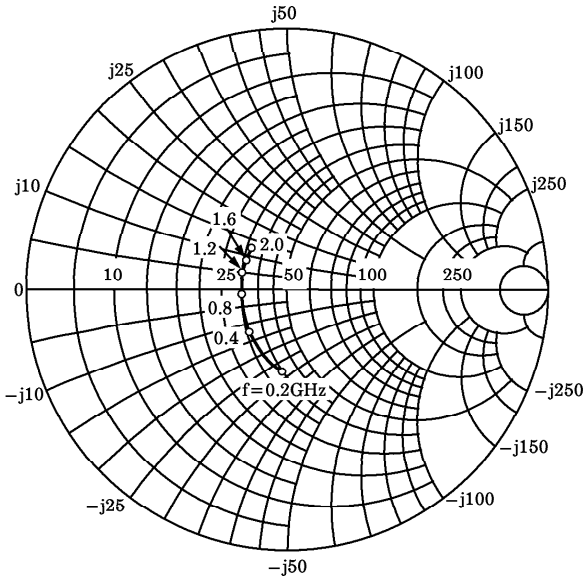
S_{12e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C



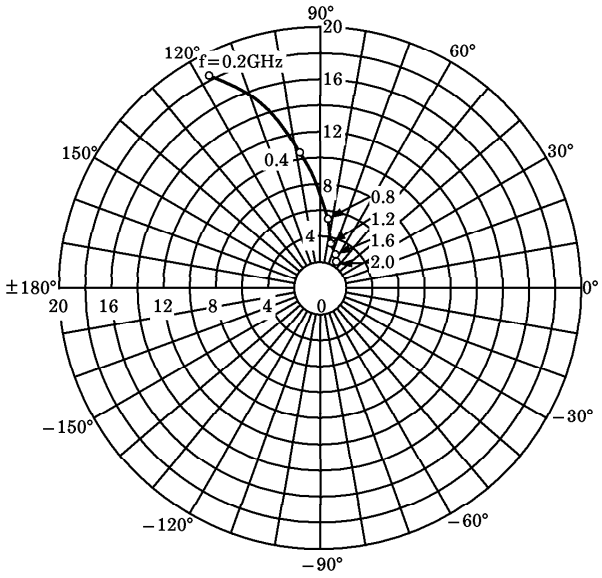
S_{22e}
V_{CE} = 8V
I_C = 5mA
Ta = 25°C
(UNIT : Ω)



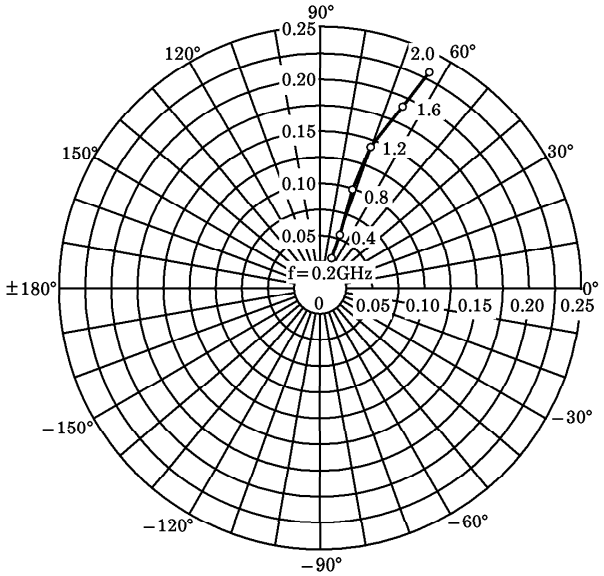
S_{11e}
V_{CE} = 8V
I_C = 20mA
Ta = 25°C
(UNIT : Ω)



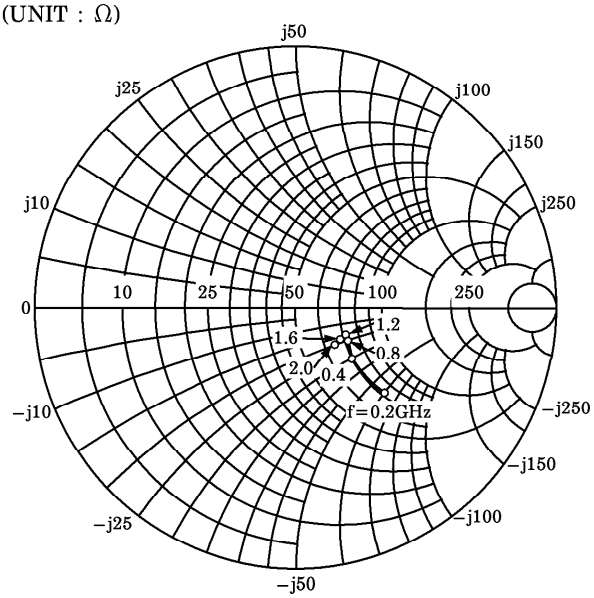
S_{21e}
V_{CE} = 8V
I_C = 20mA
Ta = 25°C



S_{12e}
V_{CE} = 8V
I_C = 20mA
Ta = 25°C



S_{22e}
V_{CE} = 8V
I_C = 20mA
Ta = 25°C
(UNIT : Ω)



RESTRICTIONS ON PRODUCT USE

000707EAA

- TOSHIBA is continually working to improve the quality and 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 comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products 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 TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- 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.