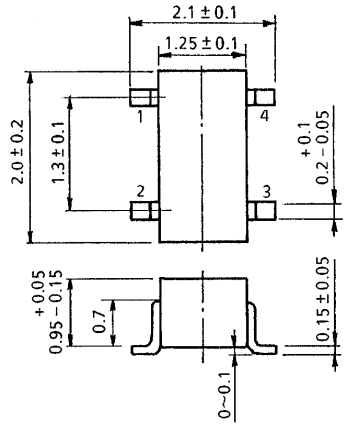
TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL PLANAR TYPE

2SC5088

VHF~UHF BAND LOW NOISE AMPLIFIER APPLICATIONS

- Low Noise Figure, High Gain.
- NF = 1.1dB, $|S_{21e}|^2$ = 13dB (f = 1GHz)

Unit in mm



1, 3. EMITTER
2. BASE
4. COLLECTOR

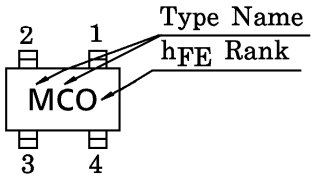
USQ	
JEDEC	—
EIAJ	—
TOSHIBA	2-2K1A

Weight : 0.006g

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	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	100	mW
Junction Temperature	T_j	125	°C
Storage Temperature Range	T_{stg}	−55~125	°C

MARKING



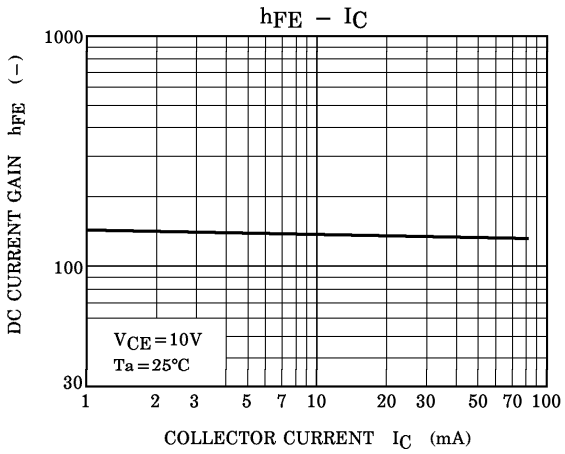
MICROWAVE CHARACTERISTICS (Ta = 25°C)

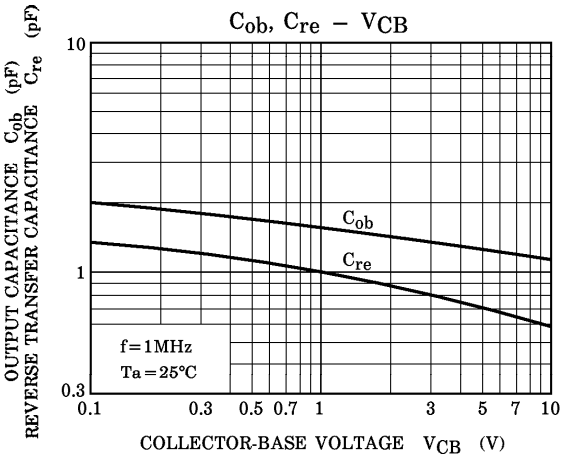
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Transition Frequency	f_T	V_{CE} = 10V, I_C = 20mA	5	7	—	GHz
Insertion Gain	$\|S_{21e}\|^2$ (1)	V_{CE} = 10V, I_C = 20mA, f = 500MHz	—	18	—	dB
	$\|S_{21e}\|^2$ (2)	V_{CE} = 10V, I_C = 20mA, f = 1GHz	9.5	13	—	
Noise Figure	NF (1)	V_{CE} = 10V, I_C = 5mA, f = 500MHz	—	1	—	dB
	NF (2)	V_{CE} = 10V, I_C = 5mA, f = 1GHz	—	1.1	2	

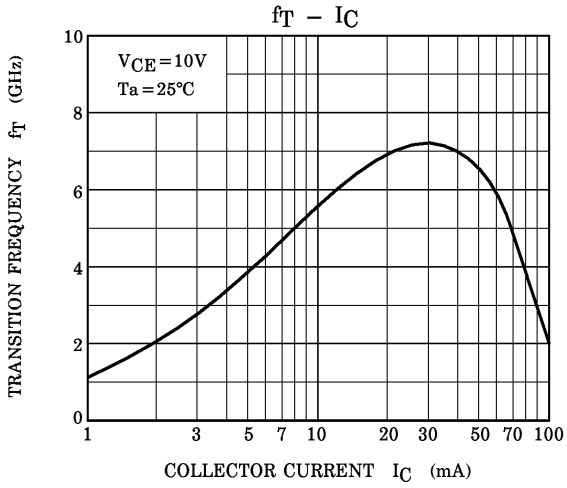
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

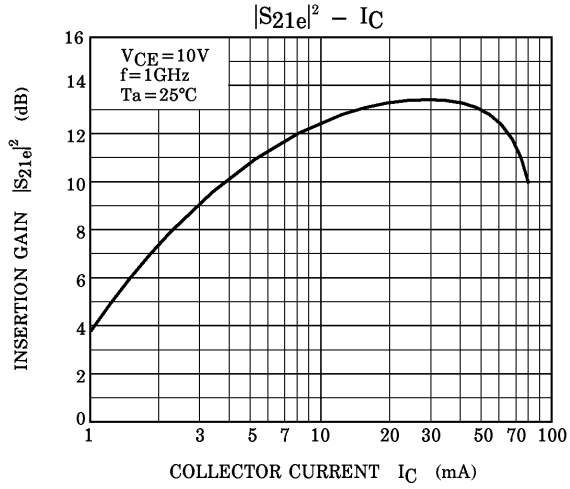
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 10V, I_E = 0	—	—	1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1V, I_C = 0	—	—	1	μA
DC Current Gain	h_{FE} (Note 1)	V_{CE} = 10V, I_C = 20mA	80	—	240	—
Output Capacitance	C_{ob}	V_{CB} = 10V, I_E = 0, f = 1MHz	—	1.1	1.6	pF
Reverse Transfer Capacitance	C_{re}	(Note 2)	—	0.65	1.05	pF

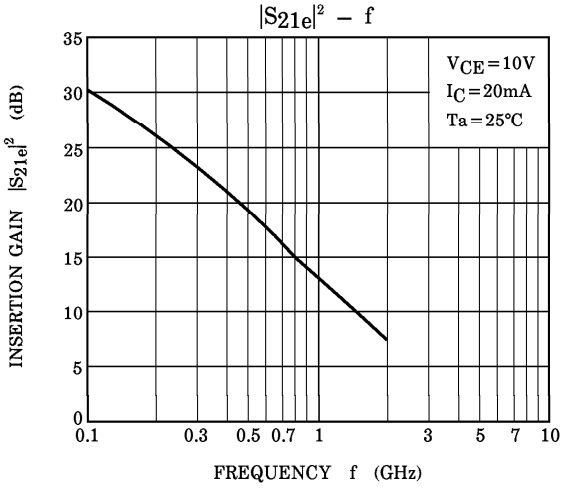
(Note 1) h_{FE} Classification O : 80~160, Y : 120~240
(Note 2) C_{re} is measured by 3 terminal method with capacitance bridge.

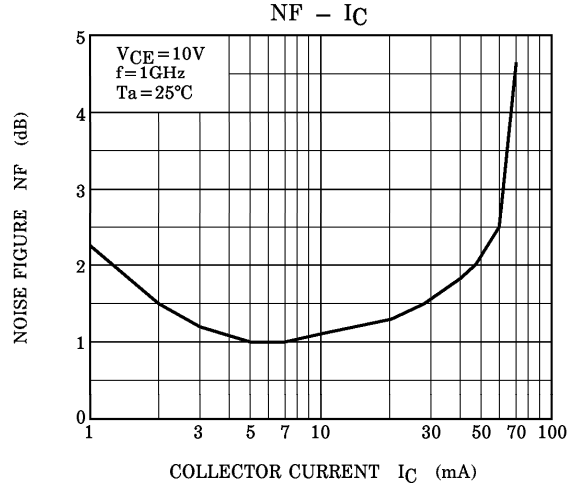

h_{FE} – I_C
DC CURRENT GAIN h_{FE} (–)
1000
100
30
V_{CE}=10V
Ta=25°C
1 2 3 5 7 10 20 30 50 70 100
COLLECTOR CURRENT I_C (mA)

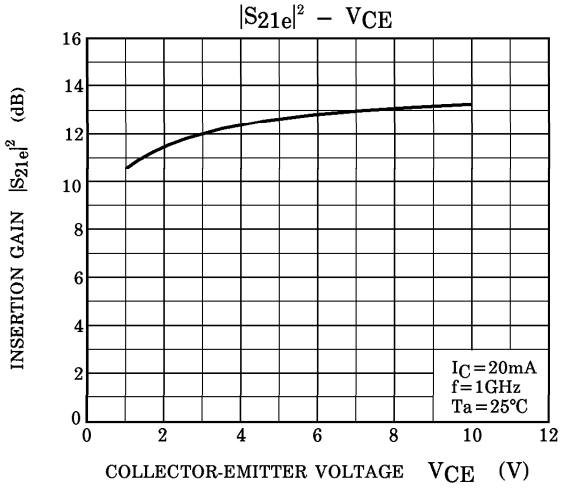

C_{ob}, C_{re} – V_{CB}
OUTPUT CAPACITANCE C_{ob} (pF)
REVERSE TRANSFER CAPACITANCE C_{re} (pF)
10
1
0.3
C_{ob}
C_{re}
f=1MHz
Ta=25°C
0.1 0.3 0.5 0.7 1 3 5 7 10
COLLECTOR-BASE VOLTAGE V_{CB} (V)

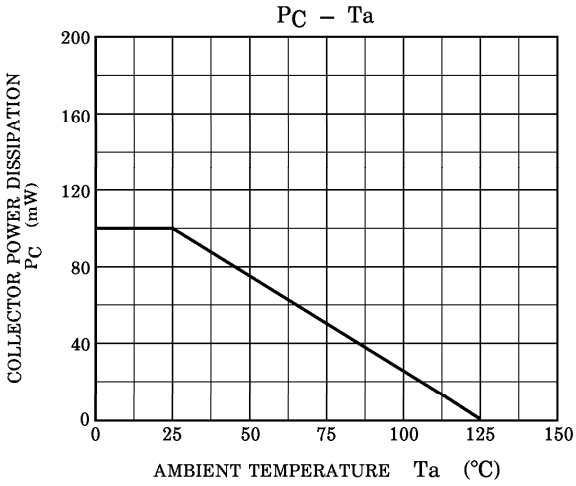

f_T – I_C
TRANSITION FREQUENCY f_T (GHz)
10
8
6
4
2
0
V_{CE}=10V
Ta=25°C
1 3 5 7 10 20 30 50 70 100
COLLECTOR CURRENT I_C (mA)


$|S_{21e}|^2$ – I_C
INSERTION GAIN $|S_{21e}|^2$ (dB)
16
14
12
10
8
6
4
2
0
V_{CE}=10V
f=1GHz
Ta=25°C
1 3 5 7 10 20 30 50 70 100
COLLECTOR CURRENT I_C (mA)


$|S_{21e}|^2$ – f
INSERTION GAIN $|S_{21e}|^2$ (dB)
35
30
25
20
15
10
5
0
V_{CE}=10V
I_C=20mA
Ta=25°C
0.1 0.3 0.5 0.7 1 3 5 7 10
FREQUENCY f (GHz)


NF – I_C
NOISE FIGURE NF (dB)
5
4
3
2
1
0
V_{CE}=10V
f=1GHz
Ta=25°C
1 3 5 7 10 30 50 70 100
COLLECTOR CURRENT I_C (mA)





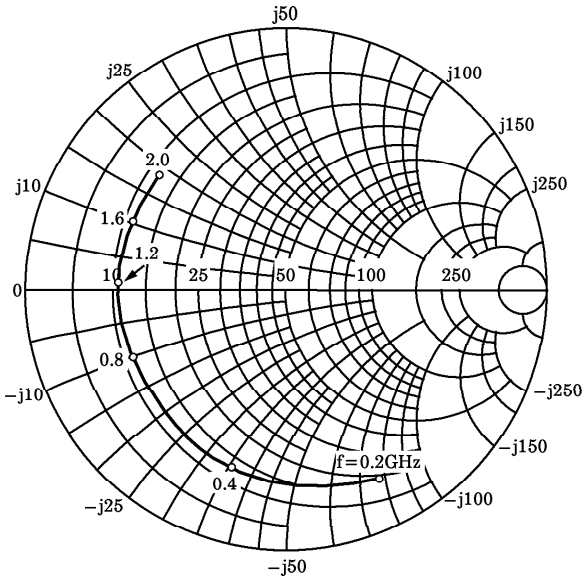
S-Parameter $Z_O = 50\Omega$, Ta = 25°C
V_{CE} = 10V, I_C = 5mA

frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.826	−64.3	9.839	139.2	0.056	59.2	0.844	−31.7
400	0.735	−106.8	7.058	115.2	0.083	43.8	0.663	−50.1
600	0.692	−134.4	5.233	99.5	0.094	36.8	0.558	−62.3
800	0.666	−154.3	4.106	88.1	0.100	33.3	0.496	−72.6
1000	0.656	−170.0	3.315	78.9	0.102	32.7	0.458	−81.8
1200	0.653	178.0	2.768	71.3	0.103	33.4	0.429	−90.6
1400	0.649	167.7	2.353	65.4	0.104	36.0	0.407	−99.4
1600	0.655	158.2	2.061	59.6	0.107	39.1	0.393	−107.8
1800	0.653	149.0	1.818	55.3	0.111	42.6	0.378	−115.3
2000	0.654	139.9	1.650	50.7	0.116	46.7	0.367	−121.9

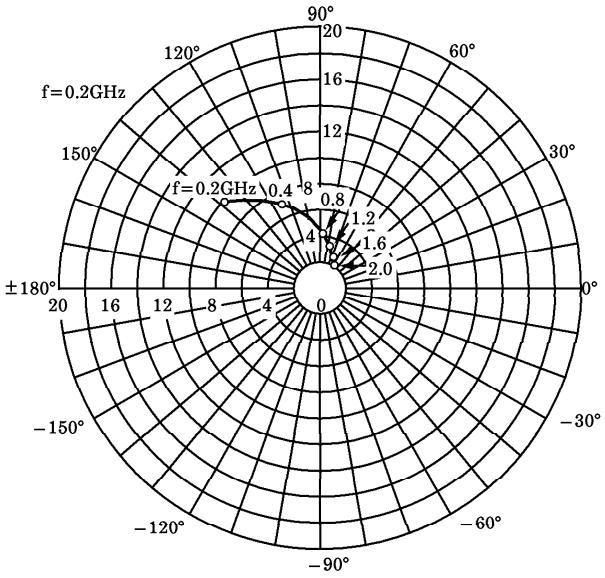
V_{CE} = 10V, I_C = 20mA

frequency	S11		S21		S12		S22	
(MHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.747	−87.0	16.492	129.8	0.048	52.1	0.717	−47.1
400	0.675	−130.5	10.431	106.5	0.063	41.8	0.486	−69.1
600	0.648	−154.8	7.298	93.5	0.070	40.8	0.379	−82.0
800	0.636	−170.9	5.547	84.4	0.076	42.0	0.324	−93.0
1000	0.630	176.7	4.423	77.5	0.083	44.7	0.291	−102.7
1200	0.634	166.4	3.660	71.7	0.089	47.7	0.266	−112.1
1400	0.634	157.1	3.125	67.0	0.097	50.8	0.249	−120.8
1600	0.639	148.8	2.741	62.4	0.105	53.2	0.233	−128.9
1800	0.645	139.9	2.451	58.8	0.115	55.6	0.220	−135.8
2000	0.642	131.4	2.233	54.9	0.126	58.1	0.205	−141.2

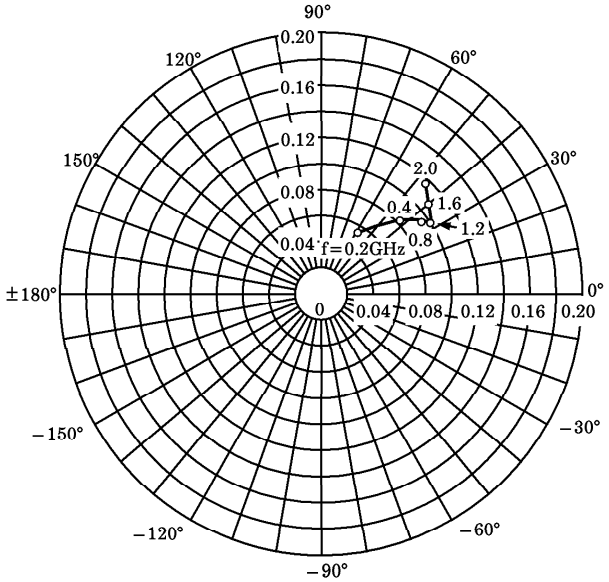
S_{11e}
V_{CE} = 10V
I_C = 5mA
Ta = 25°C
(Unit : Ω)



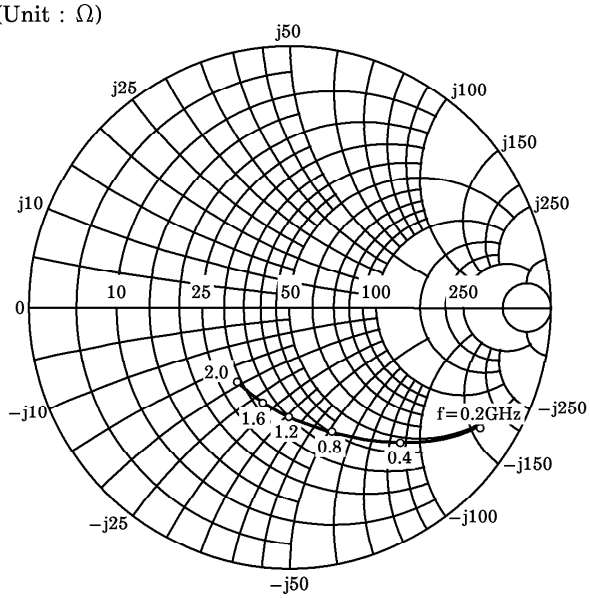
S_{21e}
V_{CE} = 10V
I_C = 5mA
Ta = 25°C



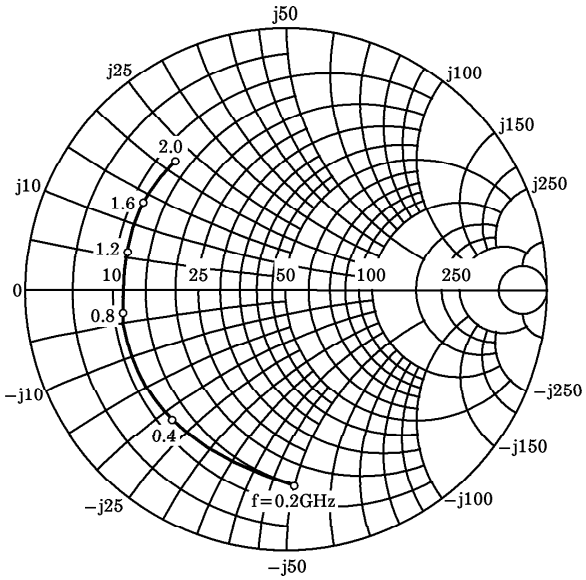
S_{12e}
V_{CE} = 10V
I_C = 5mA
Ta = 25°C



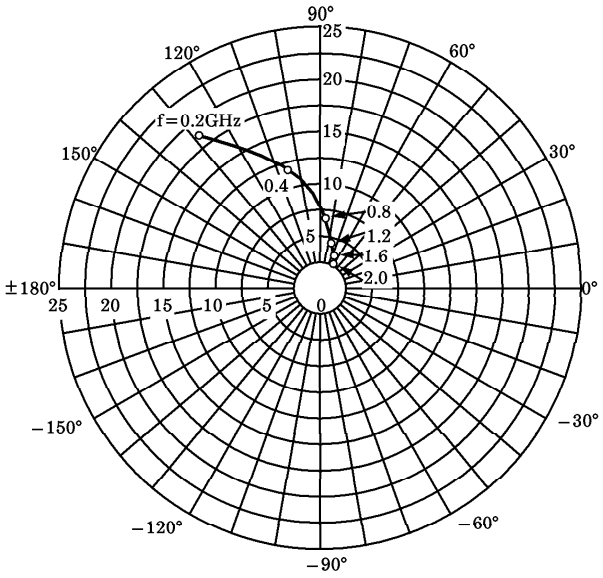
S_{22e}
V_{CE} = 10V
I_C = 5mA
Ta = 25°C
(Unit : Ω)



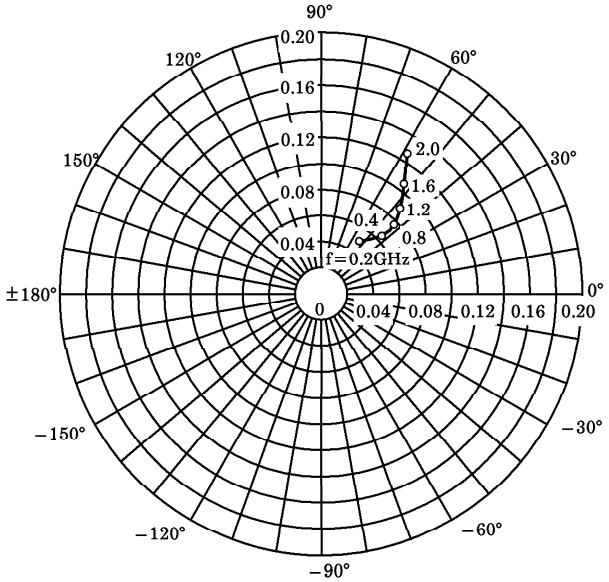
S_{11e}
V_{CE} = 10V
I_C = 20mA
Ta = 25°C
(Unit : Ω)



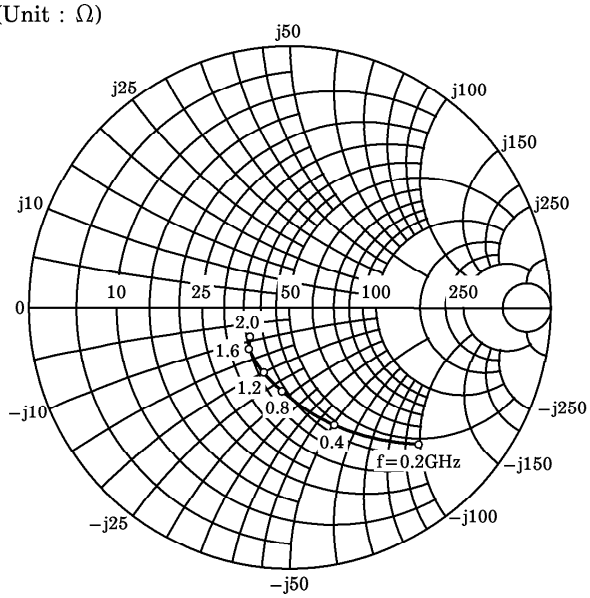
S_{21e}
V_{CE} = 10V
I_C = 20mA
Ta = 25°C



S_{12e}
V_{CE} = 10V
I_C = 20mA
Ta = 25°C



S_{22e}
V_{CE} = 10V
I_C = 20mA
Ta = 25°C
(Unit : Ω)



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