

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5319

## VHF~UHF Band Low Noise Amplifier Applications

- Low noise figure:  $NF = 1.3\text{dB}$  ( $f = 2\text{ GHz}$ )
- High gain:  $|S_{21e}|^2 = 11.5\text{dB}$  ( $f = 2\text{ GHz}$ )

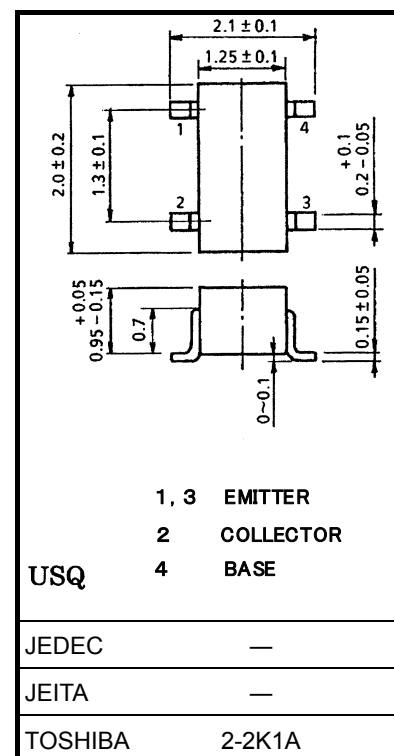
## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	8	V
Collector-emitter voltage	$V_{CEO}$	5	V
Emitter-base voltage	$V_{EBO}$	1.5	V
Collector current	$I_C$	20	mA
Base current	$I_B$	10	mA
Collector power dissipation	$P_C$	100	mW
Junction temperature	$T_j$	125	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 125	$^\circ\text{C}$

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).

Unit: mm



Weight: 6 mg (typ.)

## Microwave Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 3\text{ V}$ , $I_C = 15\text{ mA}$	13	16	—	GHz
Insertion gain	$ S_{21e} ^2 (1)$	$V_{CE} = 3\text{ V}$ , $I_C = 15\text{ mA}$ , $f = 1\text{ GHz}$	14.5	17	—	dB
	$ S_{21e} ^2 (2)$	$V_{CE} = 3\text{ V}$ , $I_C = 15\text{ mA}$ , $f = 2\text{ GHz}$	8.5	11.5	—	
Noise figure	NF (1)	$V_{CE} = 3\text{ V}$ , $I_C = 5\text{ mA}$ , $f = 1\text{ GHz}$	—	0.9	1.8	dB
	NF (2)	$V_{CE} = 3\text{ V}$ , $I_C = 5\text{ mA}$ , $f = 2\text{ GHz}$	—	1.3	2.2	

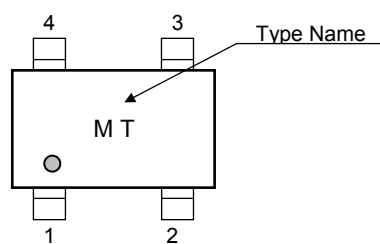
## Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

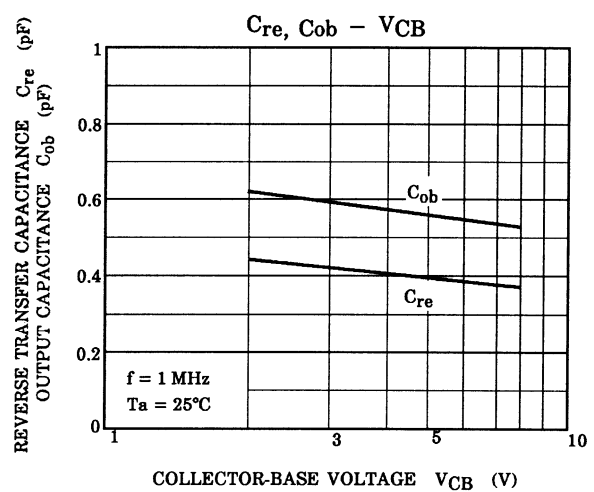
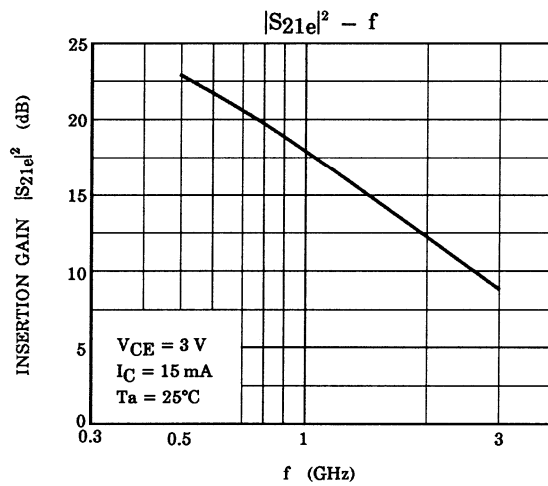
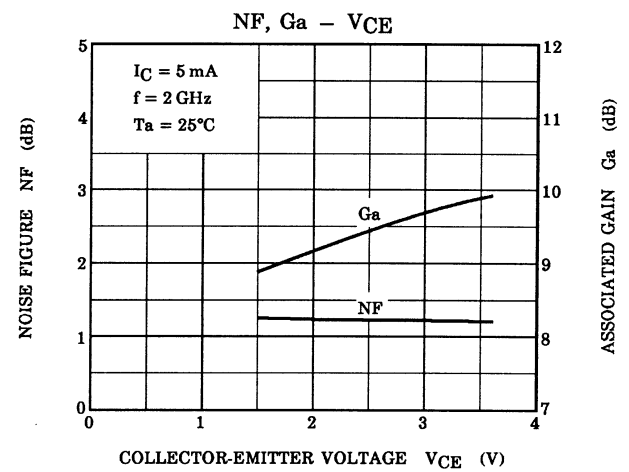
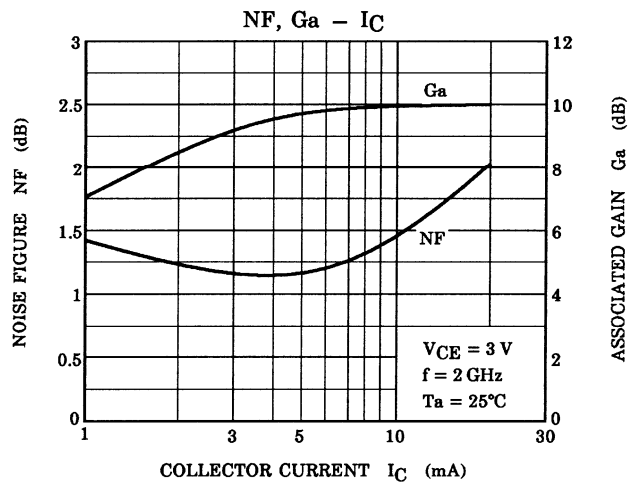
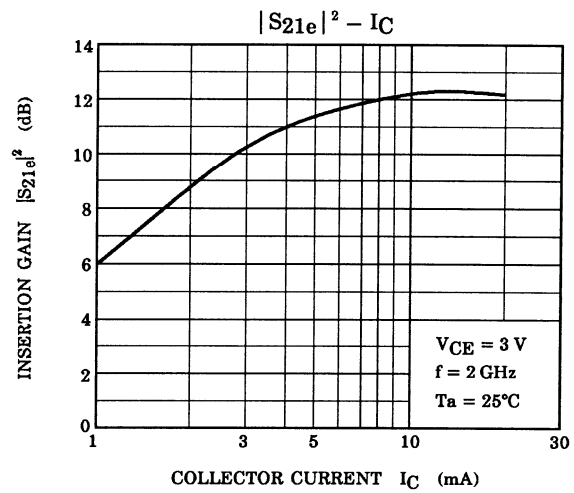
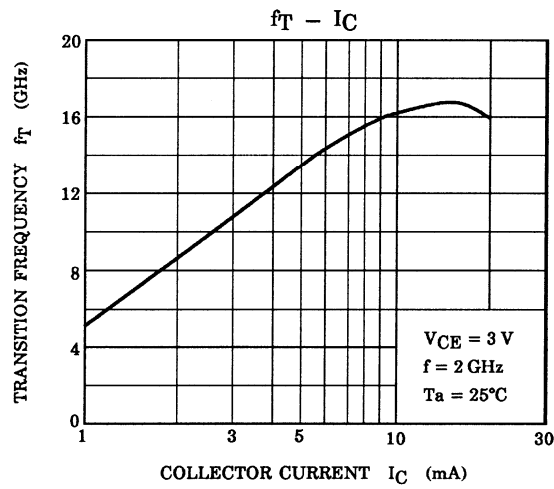
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 6\text{ V}$ , $I_E = 0$	—	—	1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{ V}$ , $I_C = 0$	—	—	1	$\mu\text{A}$
DC current gain	$h_{FE}$	$V_{CE} = 3\text{ V}$ , $I_C = 15\text{ mA}$	50	—	250	—
Output capacitance	$C_{ob}$	$V_{CB} = 2.5\text{ V}$ , $I_E = 0$ , $f = 1\text{ MHz}$ (Note)	—	0.6	—	pF
Reverse transfer capacitance	$C_{re}$		—	0.4	0.85	pF

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

**Caution**

This device is sensitive to electrostatic discharge. Please handle with caution.

**Marking**



**S-Parameter  $Z_0 = 50\ \Omega$ ,  $T_a = 25^\circ\text{C}$**  **$V_{CE} = 3\ \text{V}$ ,  $I_C = 1\ \text{mA}$** 

f (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
800	0.838	-52.3	3.011	134.2	0.146	56.2	0.880	-38.1
900	0.813	-57.7	2.956	130.8	0.161	53.4	0.854	-40.8
1000	0.793	-62.3	2.839	125.4	0.174	49.5	0.842	-44.8
1100	0.780	-67.0	2.758	122.9	0.183	46.4	0.811	-47.9
1200	0.736	-72.6	2.584	116.6	0.194	42.6	0.798	-51.6
1300	0.733	-77.0	2.597	115.6	0.198	39.5	0.778	-54.5
1400	0.709	-82.4	2.500	109.2	0.202	38.0	0.760	-57.6
1500	0.688	-87.2	2.414	105.8	0.206	36.1	0.739	-60.7
1600	0.686	-89.8	2.331	102.2	0.213	35.7	0.728	-63.5
1700	0.668	-93.8	2.229	100.1	0.228	34.4	0.713	-66.2
1800	0.643	-97.7	2.201	95.4	0.236	30.4	0.707	-69.3
1900	0.619	-102.6	2.094	90.4	0.236	27.4	0.698	-71.5
2000	0.589	-107.3	2.003	90.5	0.239	24.9	0.686	-74.7
2100	0.593	-107.8	1.941	84.9	0.236	23.0	0.678	-76.7
2200	0.560	-112.4	1.864	86.0	0.240	22.5	0.666	-79.6
2300	0.564	-116.6	1.942	79.1	0.247	19.6	0.668	-81.8
2400	0.590	-119.3	1.753	81.6	0.239	16.5	0.656	-84.0

 **$V_{CE} = 3\ \text{V}$ ,  $I_C = 3\ \text{mA}$** 

f (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
800	0.634	-83.6	6.442	118.6	0.113	48.4	0.682	-56.4
900	0.606	-91.1	6.105	114.7	0.121	45.7	0.644	-59.7
1000	0.587	-96.3	5.681	110.0	0.126	42.8	0.613	-64.2
1100	0.562	-101.2	5.375	107.1	0.131	40.8	0.582	-66.9
1200	0.528	-108.0	4.899	102.1	0.133	38.6	0.555	-70.9
1300	0.524	-113.7	4.756	100.3	0.135	37.7	0.532	-74.0
1400	0.504	-118.2	4.473	96.2	0.137	37.6	0.507	-77.1
1500	0.470	-124.2	4.223	93.0	0.140	37.0	0.489	-79.7
1600	0.480	-127.2	4.049	90.2	0.144	37.3	0.477	-82.4
1700	0.459	-128.9	3.813	88.8	0.150	35.8	0.459	-85.3
1800	0.445	-134.4	3.662	84.7	0.153	33.9	0.457	-87.7
1900	0.428	-140.0	3.441	81.0	0.153	33.3	0.442	-89.9
2000	0.424	-143.1	3.329	81.0	0.152	32.5	0.436	-92.4
2100	0.404	-145.6	3.149	77.3	0.153	33.0	0.432	-94.1
2200	0.385	-149.3	3.041	77.5	0.157	33.0	0.420	-97.2
2300	0.407	-156.7	2.999	71.6	0.159	31.6	0.421	-98.4
2400	0.437	-155.7	2.808	74.0	0.157	31.8	0.413	-100.6

$V_{CE} = 3\text{ V}$ ,  $I_C = 5\text{ mA}$ 

f (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
800	0.539	-101.6	7.906	110.6	0.093	47.0	0.557	-66.6
900	0.512	-109.5	7.361	106.9	0.098	45.0	0.516	-70.0
1000	0.498	-114.8	6.733	102.6	0.102	43.5	0.486	-74.0
1100	0.472	-122.2	6.308	100.0	0.105	42.9	0.455	-76.7
1200	0.461	-126.3	5.709	95.8	0.108	41.9	0.431	-80.0
1300	0.450	-131.8	5.487	94.0	0.109	41.9	0.411	-82.8
1400	0.439	-136.7	5.146	90.4	0.112	42.6	0.392	-86.0
1500	0.413	-143.8	4.796	87.9	0.116	42.8	0.377	-88.3
1600	0.435	-146.5	4.593	85.4	0.121	43.3	0.368	-90.9
1700	0.411	-146.6	4.305	83.9	0.126	42.5	0.355	-93.4
1800	0.402	-153.7	4.099	80.0	0.128	41.5	0.354	-95.7
1900	0.386	-159.0	3.870	77.6	0.129	41.5	0.343	-97.9
2000	0.386	-161.9	3.729	77.2	0.131	41.4	0.340	-99.9
2100	0.369	-164.5	3.519	74.1	0.133	42.4	0.337	-101.7
2200	0.368	-168.2	3.407	74.2	0.138	42.6	0.332	-104.1
2300	0.378	-172.1	3.339	69.1	0.140	41.8	0.334	-105.2
2400	0.398	-170.2	3.153	71.0	0.140	42.4	0.328	-107.2

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