

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5319

VHF~UHF Band Low Noise Amplifier Applications

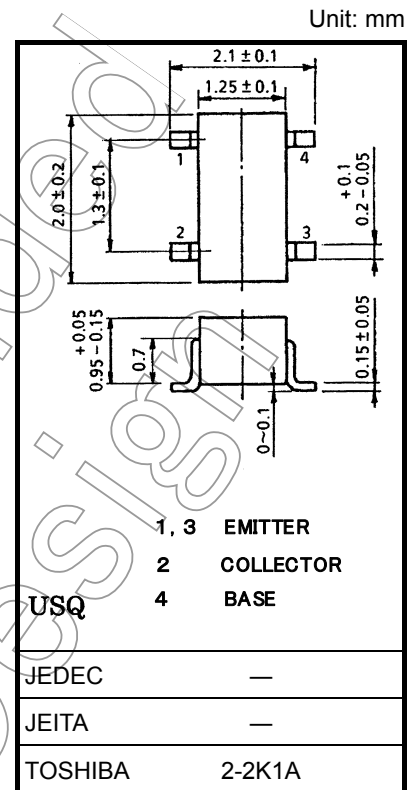
- Low noise figure: $NF = 1.3\text{dB}$ ($f = 2\text{GHz}$)
- High gain: $|S_{21e}|^2 = 11.5\text{dB}$ ($f = 2\text{GHz}$)

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 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).



Weight: 6 mg (typ.)

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	f_T	$V_{CE} \geq 3\text{V}, I_C = 15\text{mA}$	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 ($T_a = 25^\circ\text{C}$)

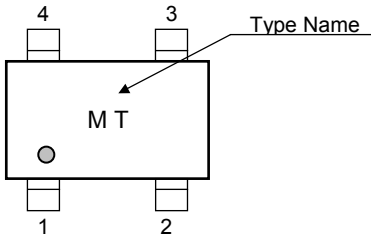
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	$V_{CB} = 6\text{V}, I_E = 0$	—	—	1	μA
Emitter cut-off current	I_{EBO}	$V_{EB} = 1\text{V}, I_C = 0$	—	—	1	μA
DC current gain	h_{FE}	$V_{CE} = 3\text{V}, I_C = 15\text{mA}$	50	—	250	—
Output capacitance	C_{ob}	$V_{CB}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

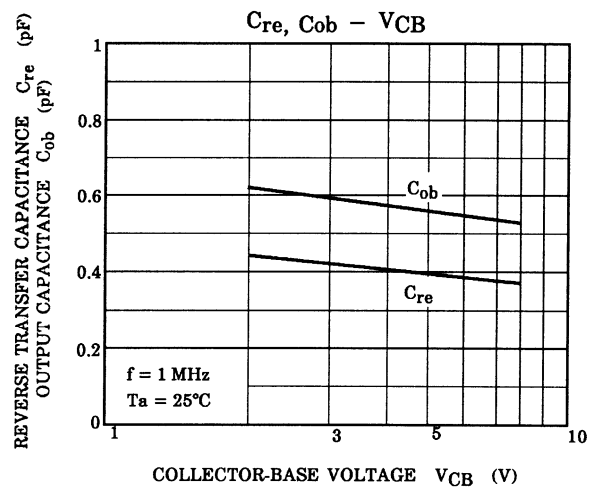
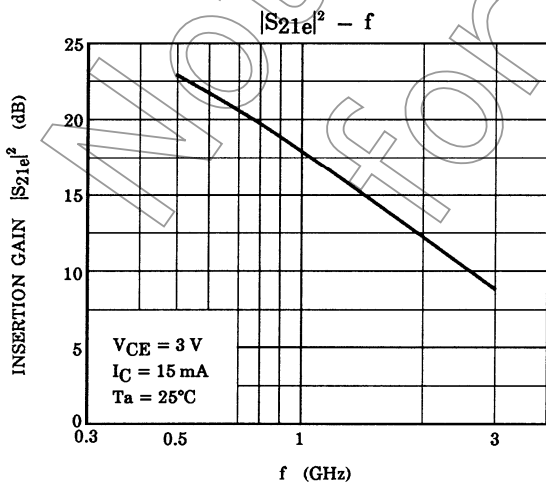
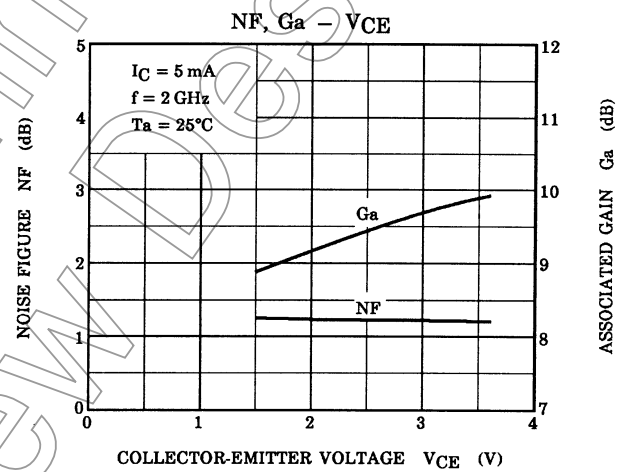
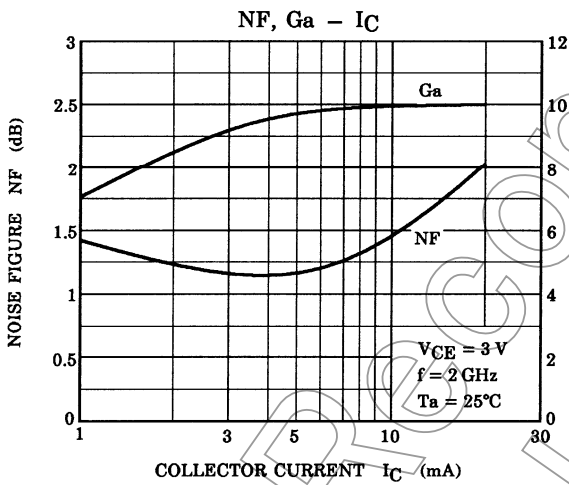
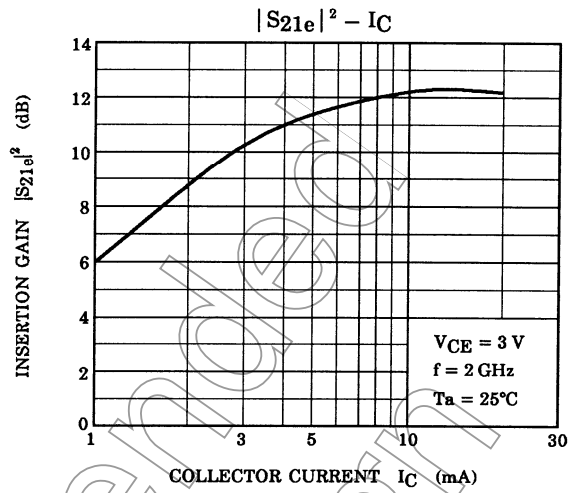
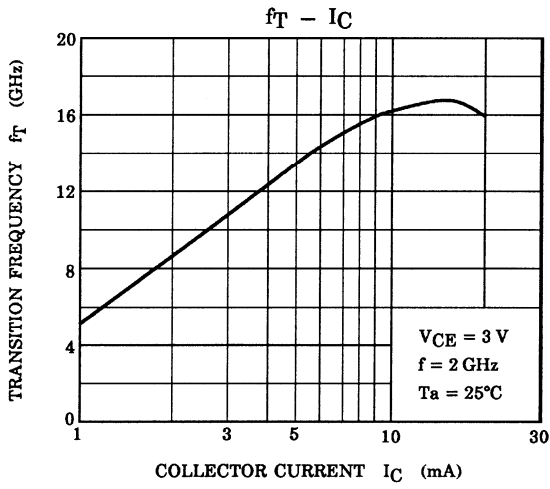
Caution

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

Marking



Not Recommended
for New Design



S-Parameter $Z_O = 50 \Omega$, $T_a = 25^\circ\text{C}$

$V_{CE} = 3 \text{ V}$, $I_C = 1 \text{ mA}$

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

Not Recommended for New Design

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- Product is intended for use in general electronics applications (e.g., computers, personal equipment, office equipment, measuring equipment, industrial robots and home electronics appliances) or for specific applications as expressly stated in this document. Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact ("Unintended Use"). Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for Unintended Use unless specifically permitted in this document.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.