

# DATA SHEET

# NEC

## NPN SILICON RF TRANSISTOR 2SC5431

### NPN EPITAXIAL SILICON TRANSISTOR FOR UHF TUNER OSC/MIX FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD

#### FEATURES

- Contains same chip as 2SC5004
- Flat-lead 3-pin thin-type ultra super minimold package

#### ★ ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5431	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5431-T1	3 kpcs/reel	• Pin 3 (collector) face the perforation side of the tape

**Remark** To order evaluation samples, contact your nearby sales office.  
The unit sample quantity is 50 pcs.

#### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V <sub>CBO</sub>	20	V
Collector to Emitter Voltage	V <sub>CEO</sub>	12	V
Emitter to Base Voltage	V <sub>EBO</sub>	3	V
Collector Current	I <sub>C</sub>	60	mA
Total Power Dissipation	P <sub>tot</sub> <sup>Note</sup>	100	mW
Junction Temperature	T <sub>j</sub>	125	°C
Storage Temperature	T <sub>stg</sub>	-65 to +125	°C

**Note** Free air

**Because this product uses high-frequency technology, avoid excessive static electricity, etc.**

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I <sub>CBO</sub>	V <sub>CB</sub> = 15 V, I <sub>E</sub> = 0 mA	–	–	100	nA
Emitter Cut-off Current	I <sub>EBO</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 mA	–	–	100	nA
Collector to Emitter Saturation Voltage	V <sub>CE (sat)</sub>	h <sub>FE</sub> = 10, I <sub>C</sub> = 5 mA	–	–	0.5	V
DC Current Gain	h <sub>FE</sub> <sup>Note 1</sup>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 5 mA	60	–	120	–
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 5 mA, f = 1 GHz	3.0	4.3	–	GHz
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 5 mA, f = 1 GHz	5.0	–	–	dB
Reverse Transfer Capacitance	C <sub>re</sub> <sup>Note 2</sup>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 mA, f = 1 MHz	–	0.6	1.2	pF

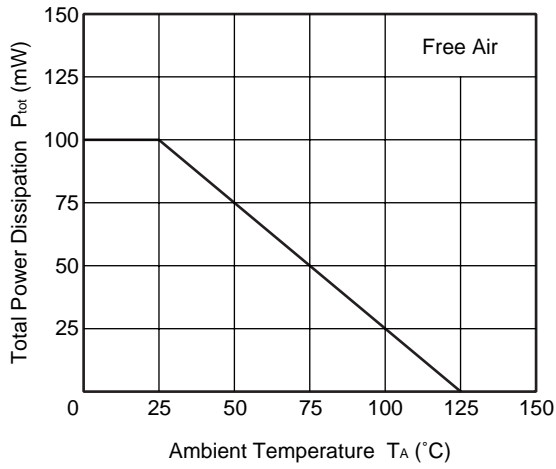
- Notes** 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%  
 2. Collector to base capacitance when the emitter grounded

**h<sub>FE</sub> CLASSIFICATION**

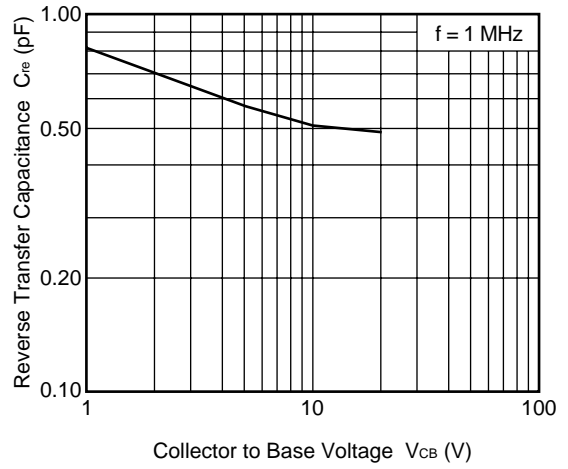
Rank	EB	FB
Marking	TA	TB
h <sub>FE</sub> Value	60 to 90	80 to 120

TYPICAL CHARACTERISTICS (Unless otherwise specified,  $T_A = +25^\circ\text{C}$ )

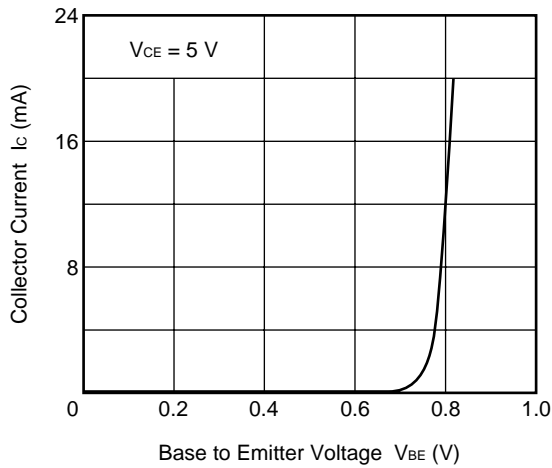
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



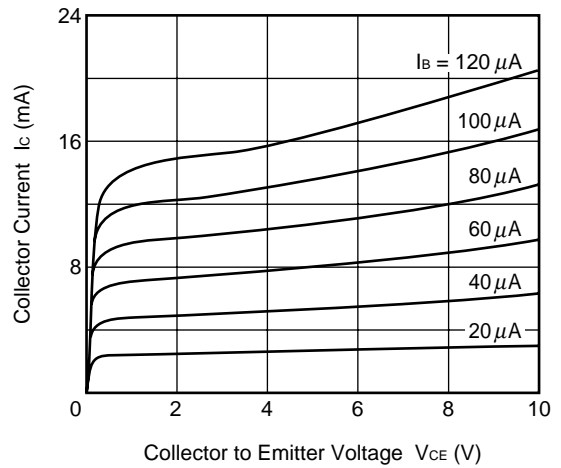
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



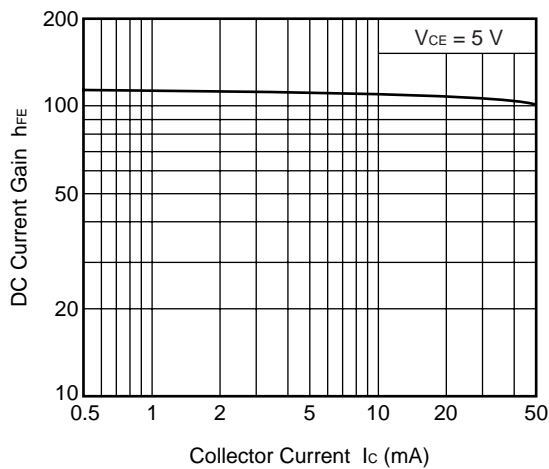
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



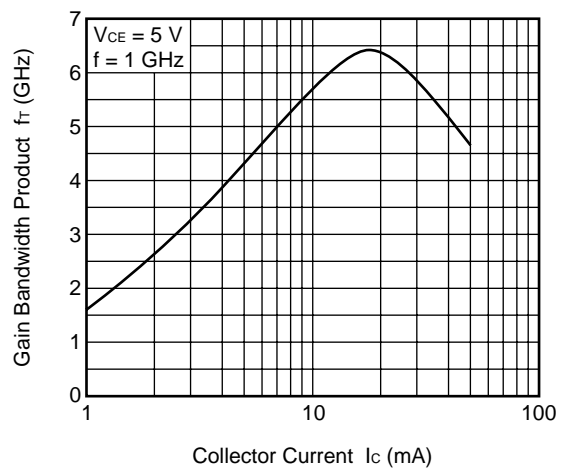
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



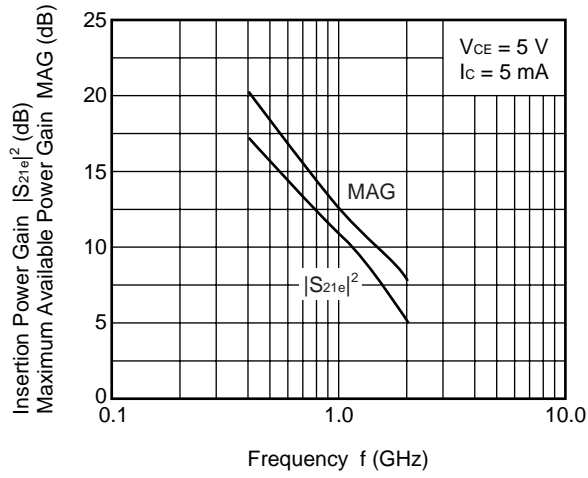
DC CURRENT GAIN vs. COLLECTOR CURRENT



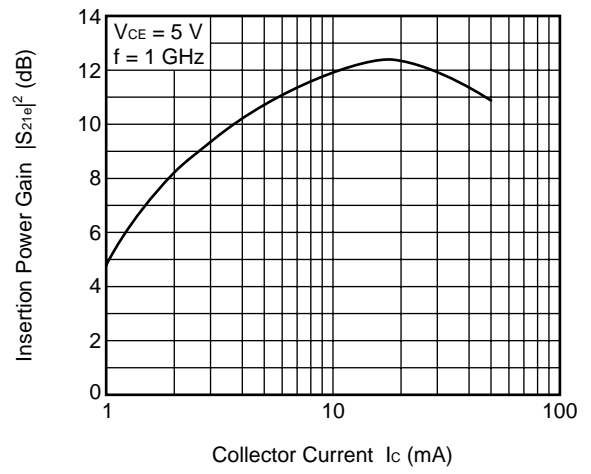
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG  
vs. FREQUENCY



INSERTION POWER GAIN  
vs. COLLECTOR CURRENT



**Remark** The graphs indicate nominal characteristics.

**S-PARAMETERS**

V<sub>CE</sub> = 3 V, I<sub>C</sub> = 1 mA, Z<sub>0</sub> = 50 Ω

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.878	-34.4	3.225	149.4	0.076	65.6	0.939	-14.8
0.4	0.699	-64.9	2.556	125.7	0.123	48.1	0.796	-25.3
0.6	0.607	-90.1	2.080	107.1	0.148	37.3	0.691	-34.0
0.8	0.531	-107.9	1.791	94.8	0.154	30.0	0.647	-40.4
1.0	0.477	-123.5	1.524	85.4	0.161	25.2	0.626	-43.9
1.2	0.450	-137.4	1.316	76.4	0.164	23.3	0.596	-46.6
1.4	0.442	-148.0	1.184	68.0	0.163	24.6	0.567	-50.9
1.6	0.427	-157.3	1.081	62.1	0.159	26.6	0.543	-56.5
1.8	0.415	-167.7	0.976	56.8	0.152	28.8	0.534	-62.8
2.0	0.426	-177.6	0.883	51.5	0.148	29.8	0.526	-69.2
2.2	0.450	-175.6	0.821	45.2	0.150	33.0	0.509	-76.5
2.4	0.467	170.7	0.786	40.7	0.153	37.3	0.508	-86.2
2.6	0.477	166.1	0.741	37.9	0.161	42.2	0.527	-94.4
2.8	0.492	161.5	0.676	34.8	0.167	46.5	0.541	-100.8
3.0	0.511	158.0	0.638	29.9	0.174	50.0	0.536	-107.8

V<sub>CE</sub> = 3 V, I<sub>C</sub> = 3 mA, Z<sub>0</sub> = 50 Ω

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.707	-53.0	7.303	137.7	0.064	58.0	0.814	-27.8
0.4	0.514	-91.3	5.041	113.3	0.091	43.6	0.575	-40.8
0.6	0.439	-116.2	3.754	97.8	0.102	38.9	0.457	-48.1
0.8	0.391	-133.8	3.018	88.9	0.107	37.8	0.404	-52.1
1.0	0.369	-148.6	2.525	82.3	0.116	38.2	0.372	-53.8
1.2	0.370	-159.9	2.132	75.2	0.125	40.2	0.343	-55.5
1.4	0.374	-167.5	1.885	68.7	0.135	43.3	0.318	-59.4
1.6	0.367	-175.1	1.693	64.2	0.141	46.6	0.299	-64.8
1.8	0.370	176.3	1.506	59.8	0.148	49.4	0.289	-70.7
2.0	0.390	168.9	1.355	55.2	0.155	50.2	0.280	-77.1
2.2	0.413	164.3	1.251	49.5	0.167	50.7	0.268	-85.6
2.4	0.430	160.7	1.189	45.0	0.180	51.9	0.272	-95.6
2.6	0.444	157.1	1.126	42.7	0.196	53.3	0.286	-104.0
2.8	0.462	153.8	1.028	39.5	0.206	54.8	0.297	-110.4
3.0	0.480	151.4	0.964	34.6	0.214	55.2	0.303	-117.3

V<sub>CE</sub> = 3 V, I<sub>C</sub> = 5 mA, Z<sub>0</sub> = 50 Ω

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.597	-65.7	9.659	130.5	0.056	53.8	0.719	-35.9
0.4	0.431	-106.4	6.136	107.4	0.075	44.3	0.463	-49.2
0.6	0.375	-130.0	4.420	93.7	0.086	43.7	0.354	-55.6
0.8	0.347	-146.7	3.497	86.2	0.093	44.8	0.305	-58.8
1.0	0.340	-160.1	2.911	80.3	0.105	47.0	0.272	-59.9
1.2	0.348	-169.5	2.441	74.2	0.116	49.1	0.246	-61.7
1.4	0.355	-175.6	2.153	68.4	0.130	51.6	0.225	-66.0
1.6	0.352	177.6	1.925	64.4	0.142	54.4	0.210	-71.9
1.8	0.359	170.0	1.706	60.4	0.152	56.4	0.200	-78.5
2.0	0.381	163.8	1.533	56.1	0.161	56.4	0.192	-86.1
2.2	0.404	160.0	1.411	50.7	0.175	55.8	0.185	-96.3
2.4	0.421	157.0	1.343	46.6	0.191	55.7	0.191	-107.2
2.6	0.435	153.7	1.270	44.3	0.209	56.3	0.206	-115.6
2.8	0.454	150.8	1.162	41.6	0.220	57.4	0.218	-122.2
3.0	0.472	149.0	1.088	36.6	0.227	57.0	0.228	-129.3

V<sub>CE</sub> = 5 V, I<sub>c</sub> = 1 mA, Z<sub>o</sub> = 50 Ω

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.886	-32.7	3.235	150.8	0.066	66.7	0.948	-12.9
0.4	0.711	-62.0	2.597	127.7	0.109	49.9	0.821	-22.2
0.6	0.616	-86.9	2.130	109.4	0.131	39.3	0.722	-30.2
0.8	0.538	-104.5	1.844	97.1	0.139	32.5	0.682	-36.4
1.0	0.481	-120.1	1.577	87.9	0.145	27.7	0.666	-39.6
1.2	0.448	-134.2	1.362	79.1	0.148	26.0	0.639	-41.9
1.4	0.437	-145.2	1.222	70.8	0.148	27.7	0.611	-45.7
1.6	0.421	-154.8	1.116	64.9	0.144	29.8	0.584	-50.7
1.8	0.407	-165.5	1.008	59.5	0.138	32.6	0.574	-56.6
2.0	0.417	-175.6	0.915	54.3	0.135	34.1	0.566	-62.5
2.2	0.439	177.1	0.849	47.8	0.138	37.8	0.550	-69.0
2.4	0.455	172.0	0.812	43.3	0.143	42.2	0.542	-77.8
2.6	0.466	167.2	0.768	40.5	0.152	47.0	0.558	-86.0
2.8	0.480	162.4	0.701	37.4	0.159	51.8	0.573	-92.3
3.0	0.499	158.8	0.661	32.5	0.167	55.6	0.566	-98.7

V<sub>CE</sub> = 5 V, I<sub>c</sub> = 3 mA, Z<sub>o</sub> = 50 Ω

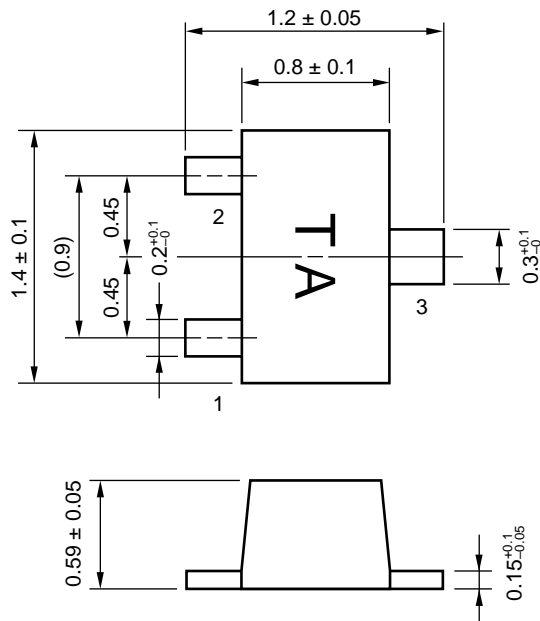
Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.723	-49.7	7.443	139.6	0.057	60.0	0.839	-24.0
0.4	0.525	-86.6	5.234	115.4	0.082	45.9	0.617	-35.2
0.6	0.444	-111.6	3.929	99.6	0.094	41.3	0.501	-41.5
0.8	0.390	-129.2	3.168	90.6	0.098	39.8	0.452	-45.1
1.0	0.362	-144.4	2.663	84.0	0.106	40.3	0.424	-46.4
1.2	0.359	-156.6	2.247	77.1	0.115	42.2	0.397	-47.3
1.4	0.362	-164.8	1.987	70.4	0.124	45.5	0.372	-50.3
1.6	0.354	-172.8	1.784	66.0	0.131	49.1	0.349	-54.8
1.8	0.356	178.2	1.589	61.6	0.138	52.4	0.338	-60.2
2.0	0.374	170.5	1.426	57.1	0.144	53.2	0.328	-65.8
2.2	0.397	165.6	1.316	51.3	0.155	54.2	0.315	-72.5
2.4	0.414	162.0	1.253	46.8	0.169	55.1	0.310	-81.4
2.6	0.429	158.2	1.186	44.2	0.185	56.6	0.320	-89.7
2.8	0.446	154.8	1.083	41.4	0.196	58.6	0.329	-96.2
3.0	0.465	152.3	1.018	36.2	0.204	59.2	0.331	-102.7

V<sub>CE</sub> = 5 V, I<sub>c</sub> = 5 mA, Z<sub>o</sub> = 50 Ω

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.675	-66.0	10.641	135.2	0.052	57.8	0.786	-29.4
0.4	0.550	-108.8	7.098	111.6	0.074	46.8	0.546	-41.0
0.6	0.513	-133.2	5.218	96.6	0.088	45.0	0.428	-47.0
0.8	0.489	-149.5	4.145	88.0	0.097	45.5	0.377	-50.1
1.0	0.487	-162.2	3.458	81.6	0.108	47.9	0.345	-50.9
1.2	0.501	-170.9	2.973	75.0	0.119	50.1	0.316	-51.8
1.4	0.508	-176.5	2.566	69.0	0.133	52.1	0.290	-54.8
1.6	0.498	177.3	2.279	64.7	0.143	55.0	0.269	-59.4
1.8	0.502	169.8	2.018	60.4	0.153	56.4	0.257	-65.0
2.0	0.524	164.0	1.800	56.0	0.162	56.5	0.246	-71.1
2.2	0.545	160.2	1.645	50.1	0.176	55.6	0.233	-78.4
2.4	0.560	156.9	1.559	45.5	0.191	55.4	0.229	-88.3
2.6	0.571	153.6	1.475	43.0	0.210	56.1	0.236	-97.3
2.8	0.585	150.5	1.337	39.9	0.222	57.1	0.239	-104.3
3.0	0.602	148.5	1.246	35.4	0.226	57.1	0.240	-110.6

★ PACKAGE DIMENSIONS

FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD (UNIT: mm)



**PIN CONNECTIONS**

- 1. Emitter
- 2. Base
- 3. Collector

- **The information in this document is current as of February, 2002. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
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M8E 00.4-0110



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► **Business issue**

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► **Technical issue**

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