

**NPN EPITAXIAL SILICON TRANSISTOR  
FOR MICROWAVE HIGH-GAIN AMPLIFICATION**

**FEATURE**

- High  $f_T$   
16 GHz TYP.
- High gain  
 $|S_{21e}|^2 = 14$  dB TYP.  
@ $f = 2$  GHz,  $V_{CE} = 2$  V,  $I_c = 20$  mA
- $NF = 1.1$  dB, @ $f = 2$  GHz  $V_{CE} = 2$  V,  $I_c = 3$  mA
- 6-pin Small Mini Mold Package

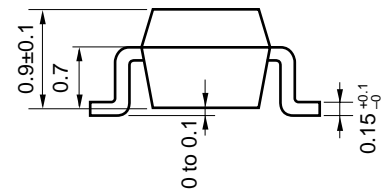
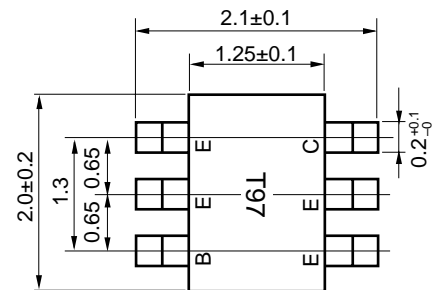
**ORDERING INFORMATION**

PART NUMBER	QUANTITY	PACKING STYLE
2SC5409-T1	3 kpcs/reel	8-mm wide emboss taping, 6-pin (collector) feed hole direction

**Remark** To order evaluation samples, consult your NEC sales personnel (supported in 50-pcs units).

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	RATING	UNIT
Collector to Base Voltage	$V_{CBO}$	5	V
Collector to Emitter Voltage	$V_{CEO}$	3	V
Emitter to Base Voltage	$V_{EBO}$	2	V
Collector Current	$I_c$	30	mA
Total Power Dissipation	$P_T$	90	mW
Junction Temperature	$T_j$	150	°C
Storage Temperature	$T_{stg}$	-65 to +150	°C

**PACKAGE DIMENSIONS (in mm)****PIN CONNECTIONS**

E: Emitter  
C: Collector  
B: Base

**Because this product uses high-frequency process, avoid excessive input of static electricity, etc.**

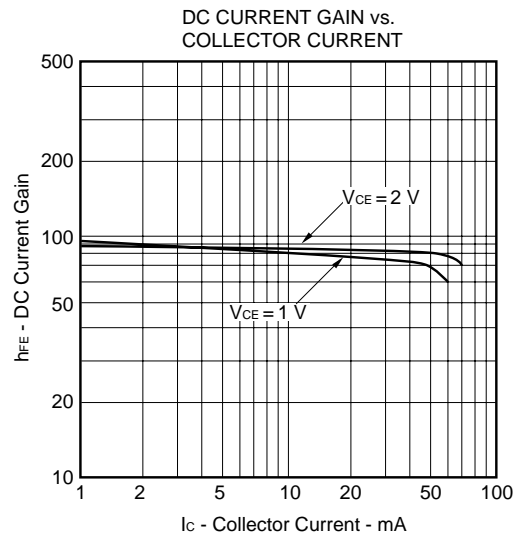
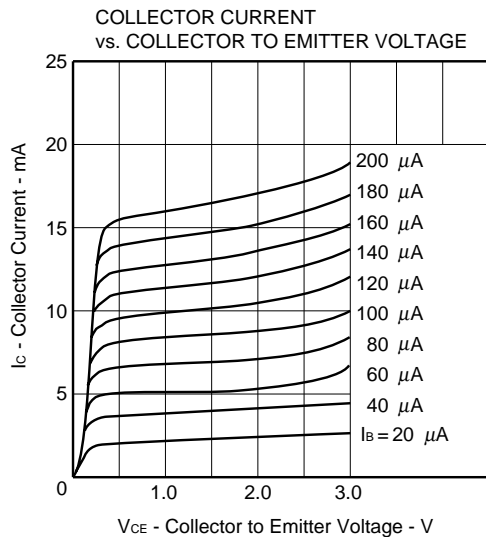
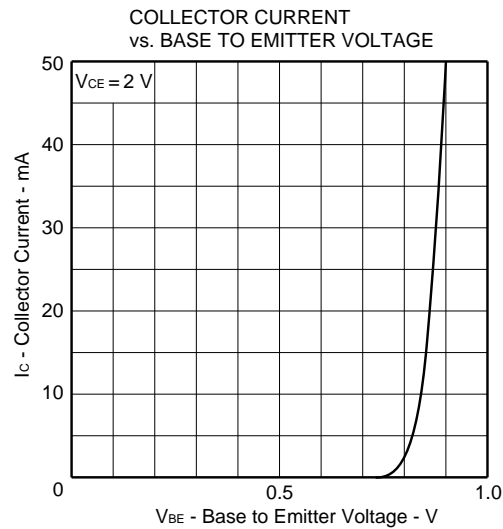
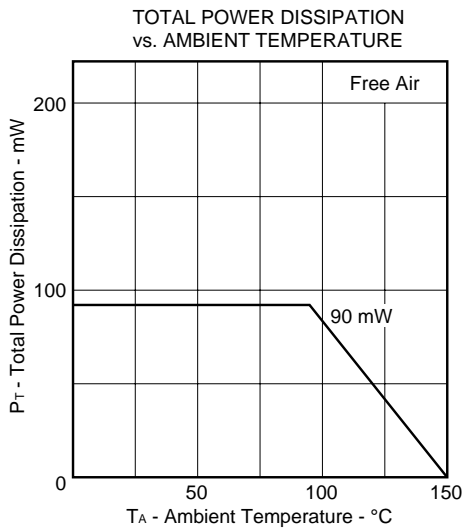
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

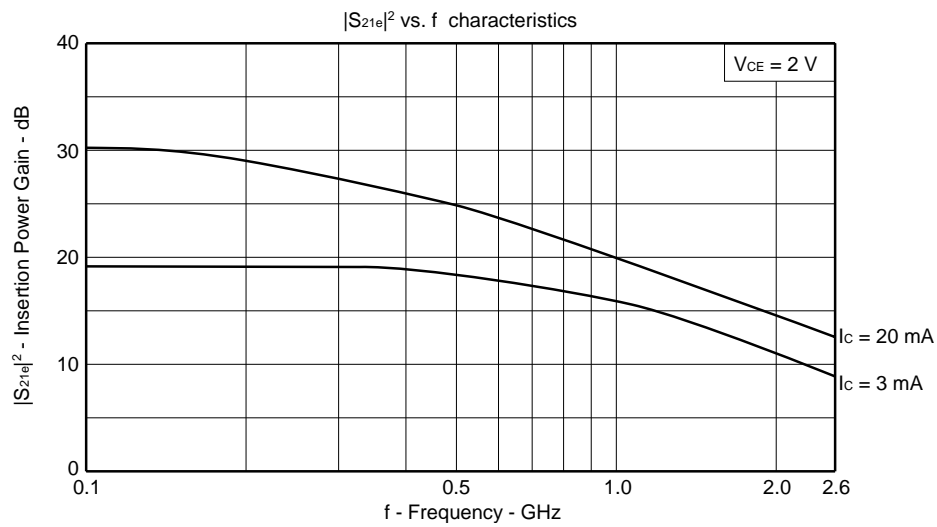
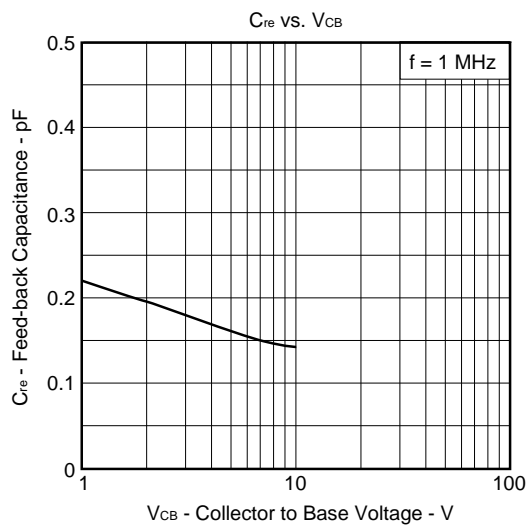
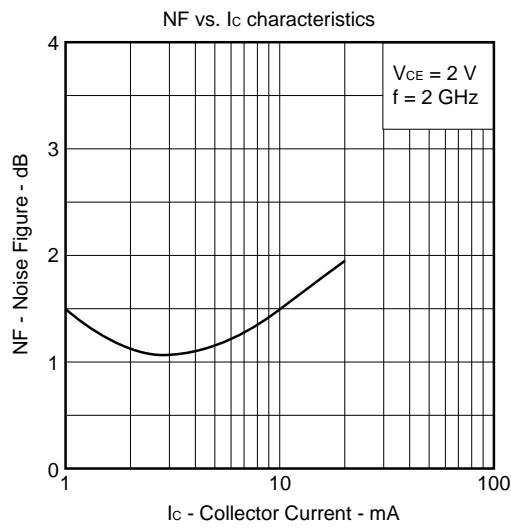
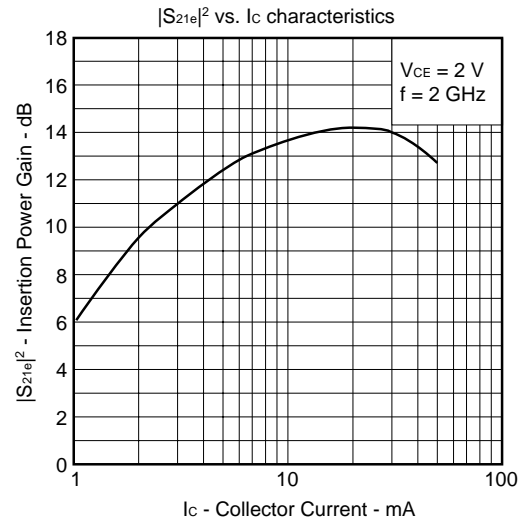
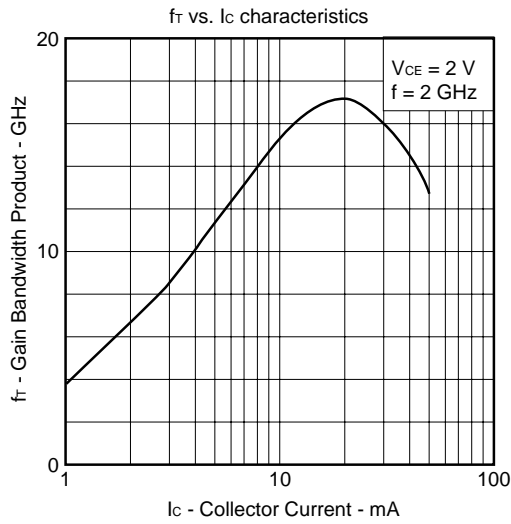
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I <sub>CB0</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0			0.1	μA
Emitter Cut-off Current	I <sub>EB0</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0			0.1	μA
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA <b>Note 1</b>	70		140	
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2.0 GHz	13	16		GHz
Feed-back Capacitance	C <sub>re</sub>	V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0, f = 1 MHz <b>Note 2</b>		0.2	0.3	pF
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2.0 GHz	12	14		dB
Noise Figure	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2.0 GHz		1.1	1.8	dB

Rank	FB
Marking	T97
h <sub>FE</sub>	70 to 140

- Notes**
1. Pulse measurement PW ≤ 350 μs, duty cycle ≤ 2 %, pulsed
  2. Measured with three-pin bridge, with emitter pin connected to the bridge guard.

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





S PARAMETER

V<sub>CE</sub> = 2 V I<sub>c</sub> = 3 mA

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.000	0.907	-11.3	7.343	170.3	0.013	81.4	0.977	-7.0
200.000	0.887	-22.7	7.221	161.1	0.026	73.9	0.960	-13.9
300.000	0.861	-33.6	6.963	152.8	0.034	66.4	0.929	-20.6
400.000	0.826	-45.1	6.563	143.9	0.045	62.4	0.894	-27.1
500.000	0.788	-54.5	6.506	134.8	0.053	55.1	0.860	-33.3
600.000	0.740	-65.4	6.264	128.6	0.062	50.1	0.815	-38.4
700.000	0.700	-75.2	5.775	120.4	0.067	44.8	0.772	-43.2
800.000	0.659	-84.6	5.644	113.8	0.073	41.1	0.734	-48.1
900.000	0.621	-94.5	5.314	108.4	0.076	35.9	0.691	-51.9
1 000.000	0.585	-103.3	4.924	101.7	0.078	33.6	0.658	-56.1
1 100.000	0.555	-112.1	4.705	95.6	0.080	29.9	0.621	-59.8
1 200.000	0.532	-121.0	4.442	90.9	0.083	27.3	0.592	-63.0
1 300.000	0.508	-129.0	4.230	85.7	0.083	24.7	0.565	-66.2
1 400.000	0.492	-137.3	3.978	81.1	0.083	23.6	0.545	-69.7
1 500.000	0.483	-145.3	3.795	76.4	0.083	21.8	0.522	-72.7
1 600.000	0.473	-153.1	3.615	72.9	0.083	19.9	0.504	-75.9
1 700.000	0.472	-160.0	3.372	69.1	0.083	19.7	0.490	-79.1
1 800.000	0.469	-167.1	3.237	63.7	0.084	17.4	0.476	-82.5
1 900.000	0.469	-173.9	3.106	60.8	0.082	16.3	0.461	-85.7
2 000.000	0.472	179.9	2.932	56.9	0.083	17.0	0.456	-89.2
2 100.000	0.479	173.9	2.825	52.9	0.084	16.1	0.446	-92.3
2 200.000	0.482	168.5	2.706	49.4	0.083	15.3	0.438	-96.1
2 300.000	0.495	163.1	2.607	46.0	0.082	14.5	0.435	-99.5
2 400.000	0.504	157.8	2.479	42.3	0.083	15.0	0.432	-103.7
2 500.000	0.512	153.7	2.403	37.4	0.080	14.7	0.429	-106.9
2 600.000	0.523	148.9	2.361	34.8	0.082	15.4	0.428	-110.8

V<sub>CE</sub> = 2 V I<sub>c</sub> = 20 mA

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.000	0.591	-30.8	33.233	157.5	0.010	76.4	0.877	-17.3
200.000	0.530	-58.2	28.692	139.8	0.018	65.2	0.773	-31.4
300.000	0.475	-80.8	24.362	126.3	0.024	59.7	0.666	-41.4
400.000	0.428	-100.1	20.644	115.9	0.028	54.2	0.573	-49.6
500.000	0.400	-115.3	17.561	107.9	0.032	51.9	0.504	-55.1
600.000	0.380	-128.9	15.258	101.2	0.035	51.0	0.446	-59.4
700.000	0.368	-140.5	13.430	95.6	0.038	50.1	0.403	-62.8
800.000	0.361	-150.7	11.977	90.7	0.040	49.1	0.369	-66.2
900.000	0.359	-159.9	10.742	86.1	0.043	49.4	0.339	-68.9
1 000.000	0.359	-167.9	9.780	82.1	0.046	49.5	0.319	-72.1
1 100.000	0.362	-174.9	8.924	78.4	0.049	48.7	0.297	-75.2
1 200.000	0.368	178.6	8.211	74.9	0.051	48.9	0.281	-77.9
1 300.000	0.373	172.9	7.608	71.4	0.054	48.8	0.268	-81.0
1 400.000	0.381	167.3	7.103	68.3	0.058	48.6	0.260	-84.7
1 500.000	0.392	162.4	6.621	65.1	0.060	48.1	0.248	-87.9
1 600.000	0.401	157.7	6.229	61.9	0.064	47.6	0.242	-91.9
1 700.000	0.410	153.9	5.884	59.2	0.067	47.2	0.239	-95.6
1 800.000	0.422	150.0	5.555	56.0	0.070	46.4	0.234	-99.9
1 900.000	0.431	146.1	5.256	53.0	0.073	45.9	0.230	-104.0
2 000.000	0.442	142.8	4.992	50.1	0.075	45.0	0.234	-108.7
2 100.000	0.455	139.7	4.755	47.3	0.078	44.3	0.232	-112.7
2 200.000	0.466	136.5	4.540	44.6	0.082	43.6	0.233	-118.4
2 300.000	0.480	134.0	4.335	41.7	0.084	42.8	0.238	-122.5
2 400.000	0.492	131.1	4.139	38.9	0.087	41.7	0.243	-128.0
2 500.000	0.502	128.6	3.972	36.1	0.090	40.6	0.244	-132.0
2 600.000	0.516	126.0	3.796	33.2	0.093	39.7	0.252	-136.4

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