



# NEC's NPN SILICON EPITAXIAL TRANSISTOR 3 PINS ULTRA SUPER MINI MOLD

## NE58219

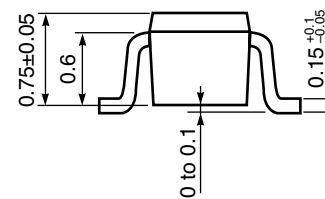
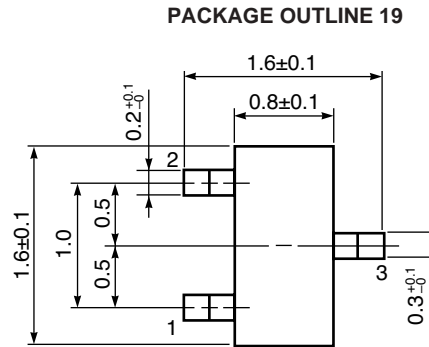
### FEATURES

- **HIGH**  $f_T$ : 5 GHz TYP at  $V_{CE} = 5\text{ V}$ ,  $I_C = 5\text{ mA}$ ,  $f = 1\text{ GHz}$
- **LOW**  $C_{re}$ : 0.9 pF TYP at  $V_{CB} = 5\text{ V}$ ,  $I_E = 0$ ,  $f = 1\text{ MHz}$
- **ULTRA SUPER MINI MOLD PACKAGE**: 1.6 x 0.8 mm

### DESCRIPTION

NEC's NE58219 is a low supply voltage transistor designed for UHF Mixer and oscillator applications. The 3 pin ultra super mini mold package makes this device ideally suited for high density surface mount assembly.

### OUTLINE DIMENSIONS (Units in mm)



#### PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE		NE58219 2SC5004 19			
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
$I_{CBO}$	Collector Cutoff Current at $V_{CB} = 15\text{ V}$ , $I_E = 0$	$\mu\text{A}$			0.1
$I_{EBO}$	Emitter Cutoff Current at $V_{EB} = 1\text{ V}$ , $I_C = 0$	$\mu\text{A}$			0.1
$V_{CE(sat)}$	Collector Saturation Voltage at $h_{FE} = 10$ , $I_C = 5\text{ mA}$	V			0.5
$h_{FE}$	DC Current Gain at $V_{CE} = 5\text{ V}$ , $I_C = 5\text{ mA}^2$		60		120
$f_T$	Gain Bandwidth at $V_{CE} = 5\text{ V}$ , $I_C = 5\text{ mA}$	GHz	3.0	5.0	
$C_{RE}$	Feedback Capacitance at $V_{CB} = 5\text{ V}$ , $I_E = 0$ , $f = 1\text{ MHz}^3$	pF		0.9	1.2
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $f = 1\text{ GHz}$	dB	5.0		

Notes:

1. Electronic Industrial Association of Japan
2. Pulsed measurement, pulse width  $\leq 350\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
3. The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** ( $T_A = 25^\circ\text{C}$ )

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CBO</sub>	Collector to Base Voltage	V	20
V <sub>CEO</sub>	Collector to Emitter Voltage	V	12
V <sub>EBO</sub>	Emitter to Base Voltage	V	3
I <sub>C</sub>	Collector Current	mA	60
P <sub>T</sub>	Total Power Dissipation	mW	100
T <sub>J</sub>	Junction Temperature	°C	125
T <sub>STG</sub>	Storage Temperature	°C	-55 to +125

Notes:

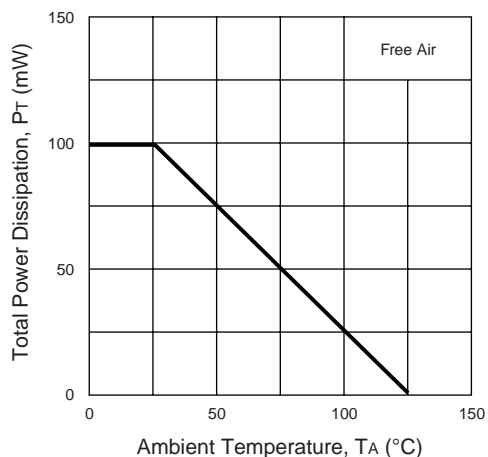
1. Operation in excess of any one of these parameters may result in permanent damage.

**ORDERING INFORMATION**

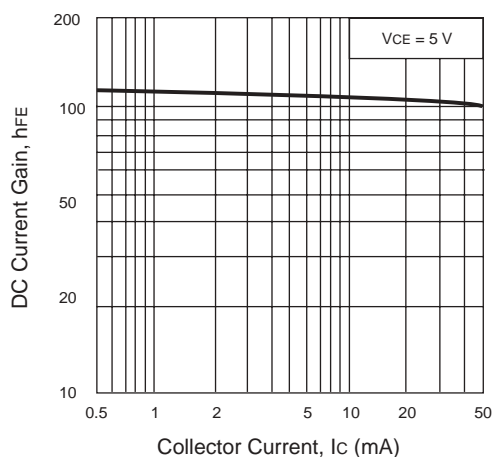
PART NUMBER	QUANTITY	PACKAGING
NE58219-T1	3000 pcs./reel	Embossed tape 8mm wide. Pin 3 (collector) face to perforation side of tape.

**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )

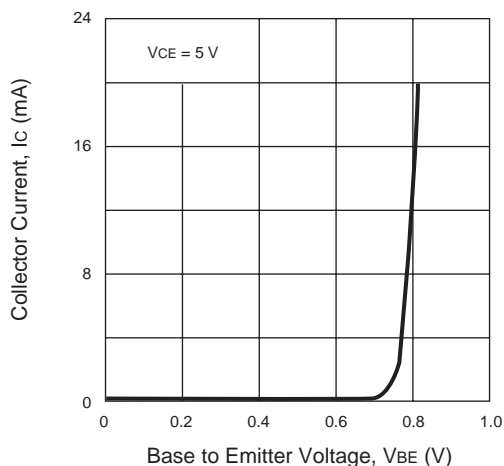
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**



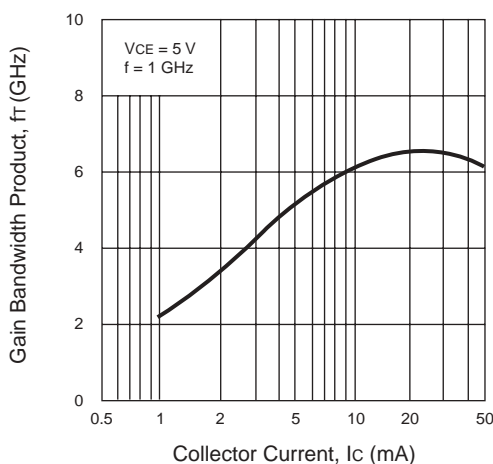
**DC CURRENT GAIN vs. COLLECTOR CURRENT**



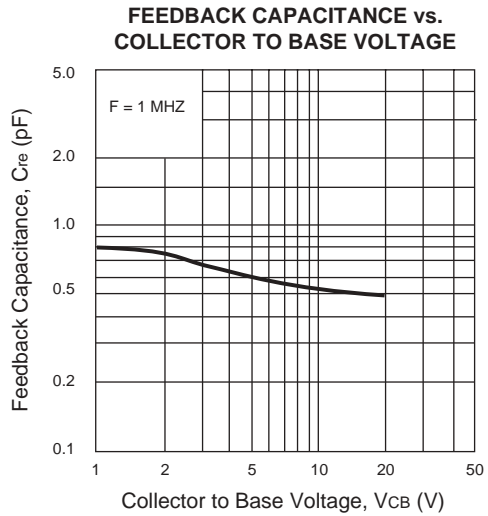
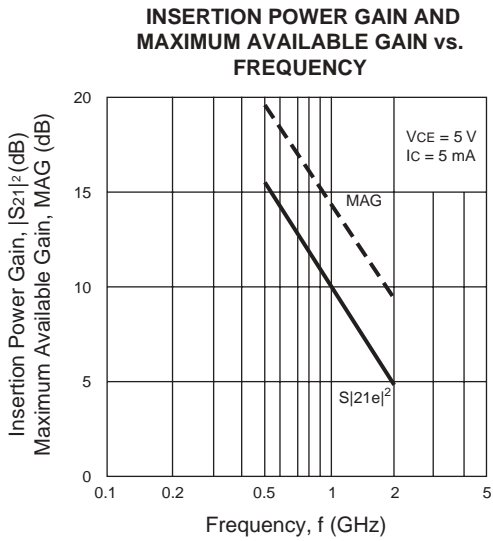
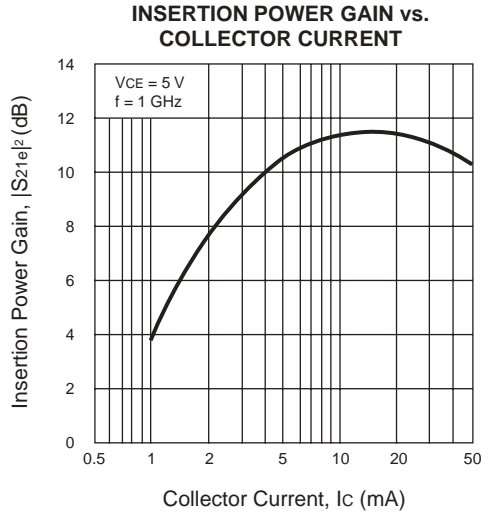
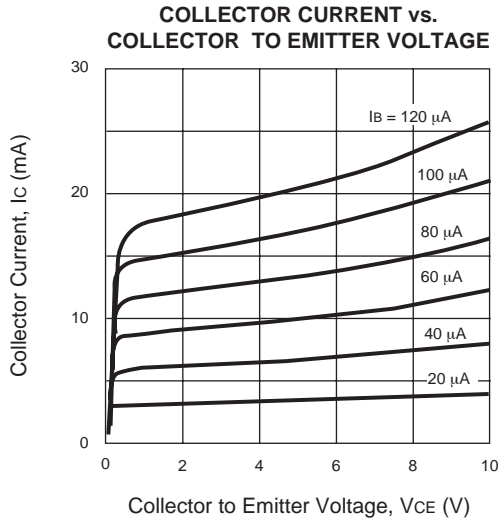
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**

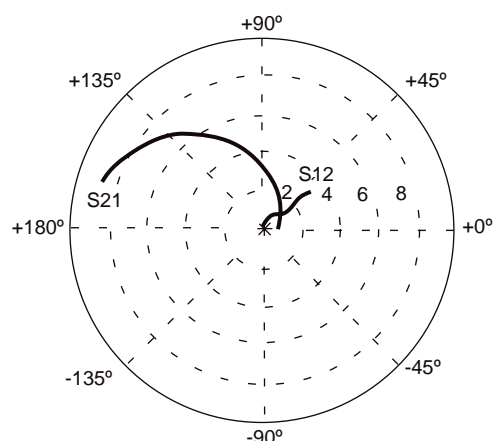
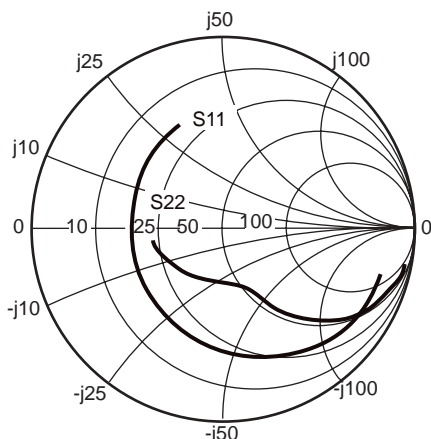


**GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT**



TYPICAL PERFORMANCE CURVES (TA = 25°C)



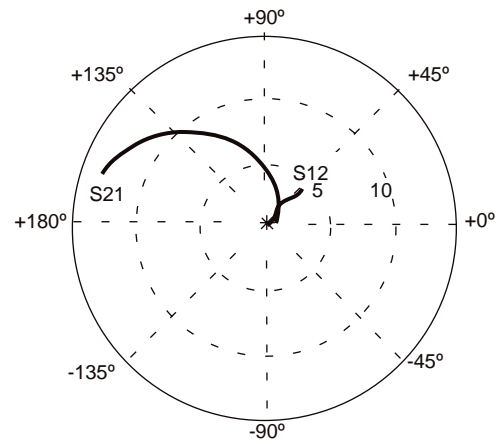
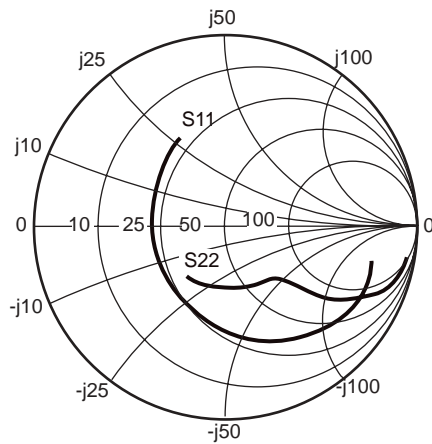
SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

## NE58219

V<sub>c</sub> = 1 V, I<sub>c</sub> = 3 mA

FREQUENCY (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>22</sub>		S <sub>12</sub>		K (unitless)	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.050	0.84	-16.28	8.69	162.16	0.95	-11.12	0.03	71.19	0.31	25.05
0.100	0.84	-33.14	8.22	155.75	0.93	-20.33	0.05	70.75	0.12	22.03
0.200	0.74	-61.59	7.05	136.55	0.79	-34.69	0.09	57.41	0.24	19.10
0.300	0.65	-84.29	5.92	122.15	0.66	-44.45	0.11	48.65	0.36	17.38
0.400	0.59	-102.61	5.00	111.38	0.57	-51.15	0.12	43.53	0.45	16.14
0.500	0.55	-117.08	4.28	102.97	0.50	-55.78	0.13	40.52	0.55	15.15
0.600	0.53	-129.02	3.72	96.03	0.44	-59.22	0.14	38.95	0.64	14.29
0.700	0.51	-138.97	3.29	90.09	0.40	-62.35	0.14	38.03	0.72	13.57
0.800	0.49	-147.58	2.94	84.92	0.37	-64.76	0.15	37.73	0.79	12.91
0.900	0.49	-155.03	2.66	80.24	0.35	-67.47	0.16	37.81	0.85	12.33
1.000	0.48	-161.81	2.44	75.92	0.33	-70.19	0.16	37.99	0.91	11.78
1.100	0.48	-167.71	2.25	71.90	0.32	-72.91	0.17	38.27	0.96	11.28
1.200	0.48	-173.05	2.09	68.18	0.31	-75.58	0.17	38.83	1.00	10.69
1.300	0.48	-177.95	1.95	64.62	0.30	-78.51	0.18	39.27	1.04	9.20
1.400	0.48	177.41	1.83	61.29	0.29	-81.48	0.19	39.74	1.07	8.34
1.500	0.48	173.15	1.73	58.09	0.28	-84.48	0.19	40.16	1.10	7.66
1.600	0.48	168.99	1.64	55.02	0.28	-87.73	0.20	40.55	1.12	7.10
1.700	0.49	165.21	1.56	52.11	0.28	-91.11	0.21	40.82	1.13	6.60
1.800	0.49	161.56	1.49	49.31	0.27	-94.65	0.21	41.19	1.14	6.16
1.900	0.49	158.14	1.43	46.56	0.27	-98.18	0.22	41.44	1.15	5.77
2.000	0.50	154.96	1.37	43.96	0.27	-101.84	0.23	41.49	1.16	5.41
2.100	0.50	152.01	1.32	41.45	0.27	-105.68	0.24	41.65	1.16	5.10
2.200	0.51	149.18	1.27	38.97	0.28	-109.36	0.24	41.72	1.15	4.81
2.300	0.51	146.47	1.23	36.71	0.28	-113.26	0.25	41.69	1.15	4.56
2.400	0.52	143.90	1.19	34.45	0.28	-117.01	0.26	41.63	1.15	4.30
2.500	0.52	141.49	1.16	32.27	0.29	-120.76	0.27	41.48	1.14	4.06
2.600	0.53	139.05	1.12	30.21	0.29	-124.41	0.28	41.14	1.14	3.83
2.700	0.53	136.85	1.09	28.21	0.29	-128.09	0.29	40.97	1.13	3.64
2.800	0.54	134.56	1.06	26.30	0.30	-131.59	0.29	40.70	1.12	3.47
2.900	0.54	132.43	1.03	24.45	0.31	-135.17	0.30	40.33	1.11	3.28
3.000	0.55	130.33	1.01	22.68	0.31	-138.54	0.31	39.92	1.11	3.11
3.100	0.55	128.52	0.98	20.96	0.32	-141.89	0.32	39.46	1.10	2.98
3.200	0.56	126.66	0.96	19.34	0.32	-145.28	0.33	38.97	1.09	2.84
3.300	0.56	124.92	0.94	17.77	0.33	-148.51	0.34	38.44	1.08	2.72
3.400	0.57	123.18	0.92	16.22	0.34	-151.84	0.35	37.80	1.07	2.59
3.500	0.57	121.66	0.90	14.75	0.34	-154.93	0.36	37.19	1.06	2.52
3.600	0.58	120.12	0.88	13.34	0.35	-158.22	0.37	36.50	1.05	2.39
3.700	0.58	118.56	0.87	12.03	0.36	-161.09	0.38	35.74	1.05	2.30
3.800	0.58	117.13	0.85	10.73	0.36	-164.14	0.39	35.00	1.04	2.19
3.900	0.59	115.69	0.84	9.51	0.37	-166.91	0.40	34.23	1.03	2.11
4.000	0.59	114.19	0.83	8.33	0.38	-169.73	0.41	33.42	1.03	2.03

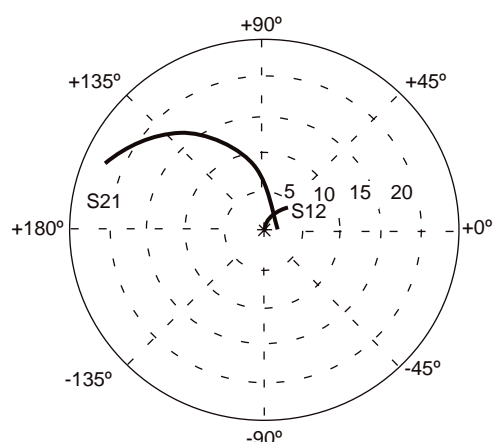
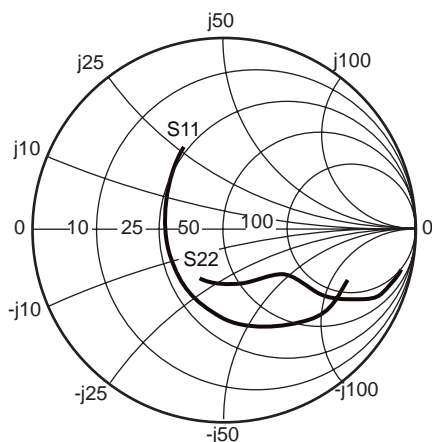
SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)



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V<sub>c</sub> = 5 V, I<sub>c</sub> = 5 mA

FREQUENCY (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>22</sub>		S <sub>12</sub>		K (unitless)	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.050	0.78	-15.97	13.43	162.03	0.95	-9.31	0.01	80.11	0.23	29.98
0.100	0.78	-32.63	12.68	155.23	0.93	-16.92	0.03	71.25	0.18	26.35
0.200	0.67	-60.08	10.68	136.09	0.79	-27.63	0.05	61.51	0.32	23.37
0.300	0.57	-81.72	8.83	122.20	0.68	-33.64	0.06	55.73	0.45	21.52
0.400	0.51	-99.23	7.37	112.16	0.59	-36.97	0.07	52.31	0.57	20.14
0.500	0.46	-113.17	6.27	104.46	0.53	-38.75	0.08	51.51	0.67	19.02
0.600	0.43	-125.01	5.42	98.23	0.49	-39.79	0.09	51.49	0.75	18.03
0.700	0.41	-134.99	4.76	92.93	0.46	-40.85	0.09	51.76	0.83	17.15
0.800	0.39	-143.77	4.24	88.36	0.44	-41.52	0.10	52.53	0.89	16.35
0.900	0.38	-151.46	3.83	84.26	0.42	-42.56	0.11	53.26	0.93	15.61
1.000	0.38	-158.46	3.49	80.48	0.40	-43.81	0.11	53.98	0.97	14.94
1.100	0.38	-164.56	3.21	76.95	0.39	-45.13	0.12	54.45	1.00	13.91
1.200	0.37	-170.14	2.97	73.66	0.38	-46.52	0.13	55.14	1.03	12.72
1.300	0.37	-175.24	2.77	70.53	0.37	-48.11	0.13	55.52	1.05	11.85
1.400	0.37	-180.00	2.60	67.57	0.37	-49.82	0.14	55.92	1.06	11.14
1.500	0.38	175.58	2.44	64.71	0.36	-51.66	0.15	56.20	1.07	10.50
1.600	0.38	171.25	2.31	61.94	0.35	-53.64	0.16	56.38	1.08	9.95
1.700	0.38	167.32	2.19	59.30	0.35	-55.69	0.17	56.44	1.08	9.46
1.800	0.39	163.57	2.09	56.73	0.34	-58.05	0.17	56.48	1.09	9.03
1.900	0.39	160.04	2.00	54.20	0.34	-60.48	0.18	56.51	1.09	8.62
2.000	0.40	156.80	1.91	51.76	0.33	-63.18	0.19	56.29	1.08	8.27
2.100	0.40	153.84	1.84	49.40	0.33	-65.85	0.20	56.10	1.08	7.96
2.200	0.41	151.04	1.77	47.03	0.33	-68.79	0.21	55.83	1.08	7.64
2.300	0.42	148.44	1.71	44.86	0.32	-71.69	0.22	55.65	1.07	7.41
2.400	0.42	145.82	1.65	42.67	0.32	-74.76	0.22	55.31	1.06	7.15
2.500	0.43	143.48	1.59	40.50	0.32	-77.76	0.23	54.82	1.05	6.96
2.600	0.43	141.09	1.54	38.43	0.32	-80.98	0.24	54.43	1.05	6.74
2.700	0.44	138.92	1.50	36.38	0.32	-84.11	0.25	54.02	1.04	6.56
2.800	0.45	136.72	1.46	34.42	0.32	-87.35	0.26	53.50	1.03	6.42
2.900	0.45	134.69	1.42	32.47	0.31	-90.64	0.27	52.95	1.02	6.31
3.000	0.46	132.66	1.38	30.58	0.31	-93.92	0.28	52.41	1.01	6.24
3.100	0.47	130.89	1.35	28.73	0.31	-97.19	0.29	51.85	1.00	6.35
3.200	0.47	129.12	1.31	26.92	0.32	-100.72	0.30	51.17	0.99	6.45
3.300	0.48	127.48	1.28	25.16	0.32	-103.97	0.31	50.59	0.98	6.21
3.400	0.48	125.87	1.25	23.43	0.32	-107.52	0.32	49.80	0.98	5.98
3.500	0.49	124.41	1.23	21.73	0.32	-110.78	0.33	49.17	0.96	5.75
3.600	0.50	122.98	1.20	20.08	0.32	-114.26	0.34	48.41	0.96	5.53
3.700	0.50	121.52	1.18	18.49	0.32	-117.44	0.35	47.56	0.95	5.31
3.800	0.51	120.14	1.15	16.93	0.33	-120.69	0.36	46.79	0.94	5.11
3.900	0.51	118.81	1.13	15.44	0.33	-123.76	0.37	46.00	0.93	4.90
4.000	0.52	117.39	1.11	13.94	0.33	-126.88	0.38	45.16	0.93	4.70

SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

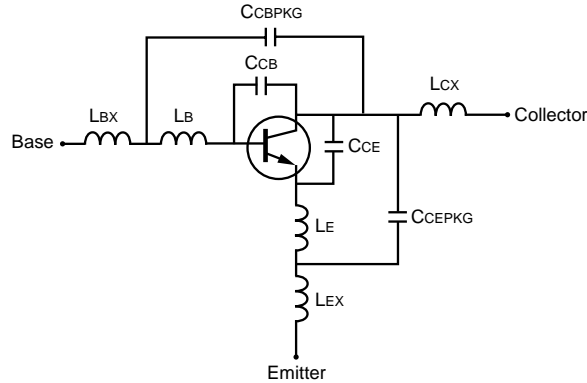
## NE58219

V<sub>c</sub> = 8 V, I<sub>c</sub> = 10 mA

FREQUENCY (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>22</sub>		S <sub>12</sub>		K (unitless)	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.050	0.67	-21.79	22.12	157.69	0.91	-12.56	0.01	73.96	0.35	32.88
0.100	0.66	-44.79	20.12	147.32	0.87	-21.76	0.02	70.10	0.26	29.06
0.200	0.51	-77.37	15.18	126.02	0.69	-31.47	0.04	60.88	0.47	26.10
0.300	0.42	-100.22	11.62	113.06	0.56	-34.70	0.05	58.80	0.65	24.07
0.400	0.38	-117.42	9.27	104.45	0.50	-35.60	0.05	59.12	0.76	22.36
0.500	0.35	-130.39	7.68	98.13	0.45	-35.57	0.06	60.14	0.85	20.95
0.600	0.33	-141.10	6.54	93.02	0.42	-35.42	0.07	61.41	0.91	19.73
0.700	0.32	-149.97	5.69	88.66	0.40	-35.64	0.08	62.39	0.95	18.64
0.800	0.32	-157.65	5.03	84.86	0.38	-35.80	0.09	63.19	0.99	17.68
0.900	0.31	-164.24	4.52	81.42	0.37	-36.49	0.09	63.82	1.01	16.11
1.000	0.31	-170.13	4.10	78.23	0.36	-37.57	0.10	64.03	1.03	15.00
1.100	0.31	-175.32	3.76	75.21	0.35	-38.79	0.11	64.23	1.04	14.04
1.200	0.32	179.93	3.47	72.37	0.35	-40.04	0.12	64.39	1.05	13.28
1.300	0.32	175.70	3.23	69.64	0.34	-41.54	0.13	64.33	1.05	12.60
1.400	0.32	171.61	3.02	67.04	0.34	-43.13	0.14	64.13	1.06	11.95
1.500	0.33	167.86	2.84	64.50	0.33	-44.89	0.15	63.73	1.06	11.37
1.600	0.33	164.10	2.68	62.04	0.32	-46.84	0.16	63.50	1.06	10.86
1.700	0.34	160.72	2.54	59.66	0.32	-48.78	0.16	63.15	1.06	10.41
1.800	0.34	157.44	2.42	57.31	0.31	-51.02	0.17	62.67	1.06	10.00
1.900	0.35	154.45	2.31	55.02	0.31	-53.26	0.18	62.20	1.05	9.61
2.000	0.35	151.60	2.21	52.78	0.31	-55.77	0.19	61.72	1.05	9.27
2.100	0.36	149.09	2.12	50.62	0.30	-58.30	0.20	61.09	1.04	8.96
2.200	0.37	146.67	2.03	48.40	0.30	-61.15	0.21	60.51	1.04	8.67
2.300	0.37	144.44	1.96	46.40	0.30	-63.92	0.22	59.93	1.03	8.45
2.400	0.38	142.19	1.90	44.33	0.29	-66.93	0.23	59.21	1.03	8.23
2.500	0.39	140.17	1.83	42.27	0.29	-69.77	0.24	58.48	1.02	8.03
2.600	0.39	138.05	1.78	40.31	0.29	-72.71	0.24	57.78	1.02	7.83
2.700	0.40	136.26	1.72	38.37	0.28	-75.76	0.25	57.18	1.01	7.77
2.800	0.41	134.26	1.67	36.47	0.28	-78.87	0.26	56.42	1.00	7.79
2.900	0.41	132.45	1.63	34.60	0.28	-82.00	0.27	55.66	1.00	7.78
3.000	0.42	130.63	1.59	32.76	0.28	-85.10	0.28	54.91	0.99	7.52
3.100	0.43	129.18	1.55	30.95	0.28	-88.23	0.29	54.16	0.98	7.27
3.200	0.43	127.63	1.51	29.18	0.28	-91.56	0.30	53.38	0.97	7.03
3.300	0.44	126.18	1.47	27.44	0.28	-94.82	0.31	52.59	0.96	6.80
3.400	0.45	124.79	1.44	25.71	0.28	-98.34	0.32	51.79	0.96	6.57
3.500	0.45	123.57	1.41	24.03	0.28	-101.39	0.33	50.96	0.95	6.34
3.600	0.46	122.30	1.38	22.35	0.28	-104.84	0.34	50.13	0.94	6.14
3.700	0.47	121.00	1.35	20.74	0.28	-107.86	0.35	49.29	0.93	5.93
3.800	0.47	119.87	1.33	19.15	0.28	-111.10	0.35	48.43	0.93	5.73
3.900	0.48	118.69	1.30	17.61	0.28	-113.87	0.36	47.61	0.92	5.54
4.000	0.48	117.43	1.28	16.07	0.29	-117.00	0.37	46.74	0.91	5.35

NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

Parameters	Q1	Parameters	Q1
IS	2.3e-16	MJC	0.28
BF	100.3	XCJC	0.2
NF	0.9917	CJS	0
VAF	31.6	VJS	0.75
IKF	2.2	MJS	0
ISE	3.5e-11	FC	0.7
NE	30	TF	12e-12
BR	13.5	XTF	4
NR	0.9899	VTF	4
VAR	3.9	ITF	0.01
IKR	0.05	PTF	50
ISC	15.4e-12	TR	1.0e-9
NC	30	EG	1.11
RE	1.4	XTB	0
RB	14	XTI	3
RBM	9	KF	0
IRB	0.003	AF	1
RC	1.6		
CJE	1.3e-12		
VJE	0.87		
MJE	0.36		
CJC	0.6e-12		
VJC	0.59		

(1) Gummel-Poon Model

ADDITIONAL PARAMETERS

Parameters	NE58219
CCB	0.03e-12
CCE	0.2e-12
LB	0.75e-9
LE	0.65e-9
CCBPKG	0.17e-12
CCEPKG	0.15e-12
LBX	0.19e-9
LCX	0.7e-9
LEX	0.19e-9

MODEL RANGE

Frequency: 0.05 to 4 GHz  
 Bias:  $V_{CE} = 1\text{ V to }8\text{ V}$ ,  $I_c = 3\text{ mA to }10\text{ mA}$   
 Date: 2/2002

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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03/03/03