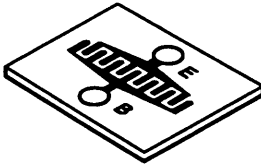
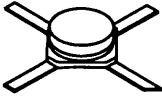

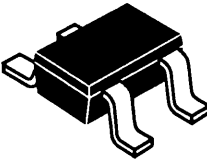

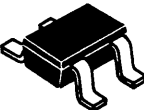



### FEATURES

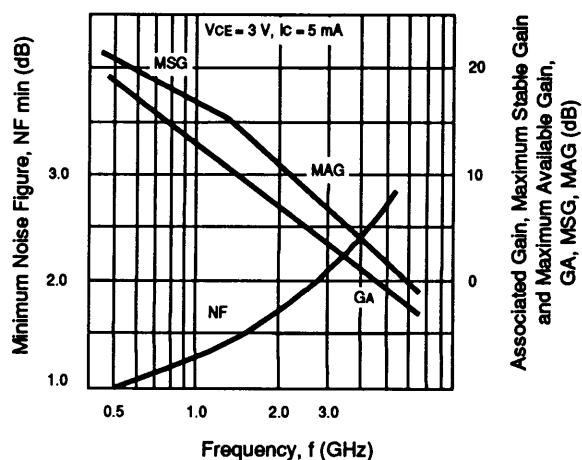
- **HIGH GAIN BANDWIDTH PRODUCT:**  $f_T = 8 \text{ GHz}$
- **LOW NOISE FIGURE:**  
1.2dB at 1 GHz  
1.6 dB at 2 GHz
- **HIGH ASSOCIATED GAIN:**  
15 dB at 1 GHz  
12 dB AT 2 GHz

### DESCRIPTION

The NE681series of NPN silicon transistors are designed for low noise and high gain amplifier applications. They offer excellent performance and reliability at low cost. The NE681 in 32 and 33 packages can be used in VHF, UHF and CATV band amplifiers while the NE 68135 can be used in amplifiers from 1 to 4GHz. The series is also available in chip form. High performance is achieved by NEC's titanium, platinum, gold and direct nitride passivation process. Low cost is achieved by NEC's high volume production capabilities.

 00 (CHIP)	 35 (MICRO-X)
 33 (SOT 23 STYLE)	 39 (SOT 143 STYLE)
 30 (SOT 323 STYLE)	 18 (SOT 343 STYLE)
 19 (3 PIN ULTRA SUPER MINI MOLD)	

**NOISE FIGURE, GAIN MSG AND MAG vs. FREQUENCY**



**ELECTRICAL CHARACTERISTICS** (TA = 25°C)

PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE			NE68100 00 (CHIP)			NE68118 2SC5012 18			NE68119 2SC5007 19			NE68130 2SC4227 30		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
ft	Gain Bandwidth Product at VCE = 8 V, IC = 20 mA VCE = 3 V, IC = 7 mA	GHz GHz		9.0			9.0			7.0			7.0	
NF	Noise Figure at VCE = 8 V, IC = 7 mA, f = 1 GHz f = 2 GHz	dB dB		1.6	2.3		1.2	2.5		1.4	1.8		1.5	1.6
GNF	Associated Gain at Noise Figure at VCE = 8 V, IC = 7 mA f = 1 GHz f = 2 GHz	dB dB		12			14			14	10		13.5	9
S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain at VCE = 8 V, IC = 20 mA, f = 1 GHz f = 2 GHz	dB dB	9	17 11		13	15 9			14	8		13	7.5
hFE	Forward Current Gain <sup>2</sup> at VCE = 8 V, IC = 20 mA VCE = 3 V, IC = 7 mA		50	100	250	50	100	250	80		160	40		240
ICBO	Collector Cutoff Current at VCB = 10 V, IE = 0	μA			1.0			1.0			1.0			1.0
IEBO	Emitter Cutoff Current at VEB = 1 V, IC = 0	μA			1.0			1.0			1.0			1.0
COB	Output Capacitance at VCB = 10 V, IE = 0, f = 1 MHz	pF		0.2	0.7									
CRE <sup>3</sup>	Feedback Capacitance at VCE = 3 V, IE = 0, f = 1 MHz VCE = 10 V, IE = 0, f = 1 MHz	pF pF					0.25	0.8		0.45	0.9		0.45	0.9
RTH (J-A)	Thermal Resistance (Junction to Ambient)	°C/W			80			833			1000			833
PT	Total Power Dissipation	mW			600			150			100			150

**ELECTRICAL CHARACTERISTICS** (TA = 25°C)

PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE			NE68133 2SC3583 33			NE68135 2SC3604 35			NE68139 2SC4094 39					
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX			
ft	Gain Bandwidth Product at VCE = 8 V, IC = 20 mA VCE = 3 V, IC = 7 mA	GHz GHz		9.0			9.0			9.0				
NF	Noise Figure at VCE = 8 V, IC = 7 mA, f = 1 GHz f = 2 GHz	dB dB		1.2	2				1.6	2.3	1.2	2		
GNF	Associated Gain at Noise Figure at VCE = 8 V, IC = 7 mA, f = 1 GHz f = 2 GHz	dB dB					13			12		13.5		
S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain at VCE = 8 V, IC = 20 mA, f = 1 GHz f = 2 GHz	dB dB		11	12.5 7	9		11				15 8.5		
hFE	Forward Current Gain <sup>2</sup> at VCE = 8 V, IC = 20 mA VCE = 3 V, IC = 7 mA		50	100	250	50	100	250	50	100	250	50	100	200
ICBO	Collector Cutoff Current at VCB = 10 V, IE = 0	μA			1.0					1.0			1.0	
IEBO	Emitter Cutoff Current at VEB = 1 V, IC = 0	μA			1.0					1.0			1.0	
COB	Output Capacitance at VCB = 10 V, IE = 0, f = 1 MHz	pF			0.35	0.9		0.2	0.7					
CRE <sup>3</sup>	Feedback Capacitance at VCE = 3 V, IE = 0, f = 1 MHz VCE = 10 V, IE = 0, f = 1 MHz	pF pF										0.3		
RTH (J-A)	Thermal Resistance (Junction to Ambient)	°C/W						625			590		625	
PT	Total Power Dissipation	mW						200			295		200	

Notes:

1. Electronic Industrial Association of Japan.
2. Pulsed (PW ≤ 350 ms, duty cycle ≤ 2 %)
3. The emitter terminal should be connected to the ground terminal of the 3 terminal capacitance bridge.

# NE681 SERIES

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup> (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub>	Collector to Base Voltage	V	20
V <sub>CE0</sub>	Collector to Emitter Voltage	V	10
V <sub>EB0</sub>	Emitter to Base Voltage	V	1.5
I <sub>C</sub>	Collector Current	mA	65
T <sub>J</sub>	Operating Junction Temperature	°C	150 <sup>2</sup>
T <sub>STG</sub>	Storage Temperature	°C	-55 to +150 <sup>3</sup>

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. T<sub>J</sub> for NE68135 and NE68100 is 200°C.
3. Maximum storage temperature for the NE68135 is -65 to +150°C.

## NE68119

### TYPICAL NOISE PARAMETERS (T<sub>A</sub> = 25°C)

FREQ. (MHz)	NF <sub>OPT</sub> (dB)	G <sub>A</sub> (dB)	Γ <sub>OPT</sub>		R <sub>n/50</sub>
			MAG	ANG	
<b>VCE = 2.5 V, I<sub>C</sub> = 0.3 mA</b>					
500	1.24	11.0	0.73	42	1.70
800	1.67	7.1	0.74	72	1.01
1000	2.18	5.2	0.70	90	0.78
<b>VCE = 2.5 V, I<sub>C</sub> = 1 mA</b>					
500	0.97	15.2	0.66	43	0.46
800	1.19	11.1	0.59	68	0.35
1000	1.31	9.2	0.56	89	0.30
1500	1.71	5.9	0.50	131	0.16
<b>VCE = 2.5 V, I<sub>C</sub> = 3 mA</b>					
500	0.92	17.7	0.49	39	0.28
800	1.02	13.7	0.40	68	0.17
1000	1.11	11.8	0.38	87	0.14
1500	1.42	8.3	0.39	134	0.08
2000	1.82	5.9	0.36	165	0.11
<b>VCE = 3 V, I<sub>C</sub> = 5 mA</b>					
500	1.00	19.0	0.37	43	0.20
800	1.10	15.0	0.31	71	0.15
1000	1.19	13.1	0.30	89	0.13
1500	1.40	9.6	0.33	139	0.09
2000	1.70	7.2	0.32	166	0.11
2500	2.05	5.3	0.36	-163	0.13
<b>VCE = 8 V, I<sub>C</sub> = 7 mA</b>					
500	1.10	20.3	0.36	39	0.22
800	1.20	16.3	0.28	64	0.16
1000	1.30	14.4	0.28	81	0.14
1500	1.50	10.9	0.28	130	0.11
2000	1.77	8.4	0.28	158	0.12
2500	2.10	6.5	0.33	-166	0.14
3000	2.40	5.0	0.44	-141	0.16

## NE68100

### TYPICAL NOISE PARAMETERS (T<sub>A</sub> = 25°C)

FREQ. (MHz)	NF <sub>OPT</sub> (dB)	G <sub>A</sub> (dB)	Γ <sub>OPT</sub>		R <sub>n/50</sub>
			MAG	ANG	
<b>VCE = 8 V, I<sub>C</sub> = 7 mA</b>					
500	1.3	23	0.20	91	0.20
1000	1.45	18	0.20	148	0.21
2000	2.1	13	0.22	178	0.51
4000	3.25	8	0.42	-115	0.85

## NE68130

### TYPICAL NOISE PARAMETERS (T<sub>A</sub> = 25°C)

FREQ. (MHz)	NF <sub>OPT</sub> (dB)	G <sub>A</sub> (dB)	Γ <sub>OPT</sub>		R <sub>n/50</sub>
			MAG	ANG	
<b>VCE = 2.5 V, I<sub>C</sub> = 0.3 mA</b>					
500	1.48	10.0	0.74	43	1.35
800	1.90	7.4	0.72	79	0.92
1000	2.15	6.2	0.69	99	0.60
1500	2.70	3.9	0.66	126	0.38
<b>VCE = 2.5 V, I<sub>C</sub> = 1 mA</b>					
500	1.10	14.3	0.65	45	0.42
800	1.26	11.5	0.60	80	0.30
1000	1.40	10.1	0.56	99	0.24
1500	1.80	7.7	0.53	123	0.17
2000	2.22	6.0	0.47	166	0.12
2500	2.75	4.6	0.49	-166	0.08
<b>VCE = 2.5 V, I<sub>C</sub> = 3 mA</b>					
500	1.00	16.5	0.47	44	0.25
800	1.06	13.5	0.44	83	0.21
1000	1.16	12.2	0.43	100	0.17
1500	1.46	9.5	0.39	130	0.12
2000	1.80	7.7	0.35	172	0.11
2500	2.15	6.2	0.35	-177	0.09
<b>VCE = 8 V, I<sub>C</sub> = 7 mA</b>					
500	1.30	18.0	0.29	50	0.27
1000	1.40	13.5	0.25	84	0.18
2000	1.80	9.0	0.25	155	0.16
3000	2.50	6.5	0.48	-167	0.10
4000	3.60	4.5	0.67	-135	0.20

**NE68133**

**TYPICAL NOISE PARAMETERS** (TA = 25°C)

FREQ. (MHz)	NF <sub>OPT</sub> (dB)	GA (dB)	Γ <sub>OPT</sub>		Rn/50
			MAG	ANG	
<b>VCE = 2.5 V, Ic = 0.3 mA</b>					
500	1.21	9.9	0.75	47	1.15
800	1.69	8.2	0.74	72	0.97
1000	1.95	6.7	0.68	88	0.71
1500	2.52	4.2	0.63	122	0.34
<b>VCE = 2.5 V, Ic = 1.0 mA</b>					
500	.92	13.0	0.68	47	0.42
800	1.20	11.3	0.63	70	0.34
1000	1.35	10.0	0.57	87	0.30
1500	1.71	7.4	0.50	120	0.17
2000	2.00	5.6	0.44	168	0.11
<b>VCE = 2.5 V, Ic = 3 mA</b>					
500	0.86	15.3	0.54	47	0.24
800	1.00	13.5	0.51	67	0.20
1000	1.08	12.0	0.46	86	0.18
1500	1.25	9.1	0.36	128	0.12
2000	1.40	7.0	0.35	172	0.10

**NE68135**

**TYPICAL NOISE PARAMETERS** (TA = 25°C)

FREQ. (MHz)	NF <sub>OPT</sub> (dB)	GA (dB)	Γ <sub>OPT</sub>		Rn/50
			MAG	ANG	
<b>VCE = 8 V, Ic = 7 mA</b>					
1000	1.1	15	0.28	65	0.22
2000	1.6	12	0.37	139	0.15
4000	3.4	9	0.51	-139	0.27

**NE68139**

**TYPICAL NOISE PARAMETERS** (TA = 25°C)

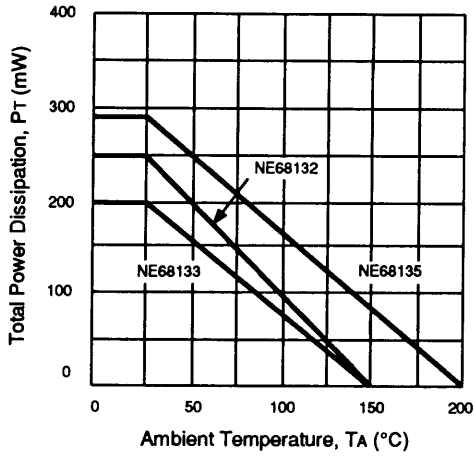
FREQ. (MHz)	NF <sub>OPT</sub> (dB)	GA (dB)	Γ <sub>OPT</sub>		Rn/50
			MAG	ANG	
<b>VCE = 2.5 V, Ic = 0.3 mA</b>					
500	1.20	11.3	0.78	47	1.28
800	1.45	8.3	0.75	72	0.84
1000	1.67	6.9	0.68	95	0.56
<b>VCE = 2.5 V, Ic = 1 mA</b>					
500	0.90	14.5	0.63	44	0.43
800	1.10	11.8	0.56	72	0.26
1000	1.26	10.6	0.53	98	0.20
1500	1.70	8.2	0.49	145	0.12
2000	2.20	6.6	0.57	178	0.07
<b>VCE = 2.5 V, Ic = 3 mA</b>					
500	0.88	16.4	0.45	44	0.25
800	1.00	13.8	0.39	73	0.19
1000	1.08	12.5	0.37	99	0.16
1500	1.30	10.2	0.35	151	0.09
2000	1.80	8.6	0.43	-177	0.07
<b>VCE = 8 V, Ic = 7 mA</b>					
500	1.15	20.5	0.26	42	0.17
1000	1.25	15.5	0.16	133	0.14
1500	1.4	13.0	0.20	176	0.09
2000	1.6	11.0	0.31	-165	0.14
3000	2.15	8.0	0.53	-123	0.48
4000	3.0	6.0	0.71	-101	0.90



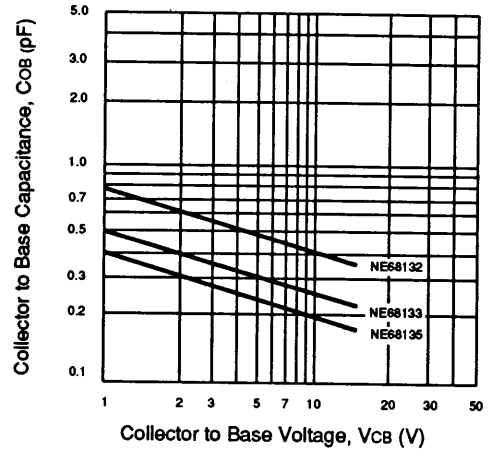
# NE681 SERIES

## TYPICAL PERFORMANCE CURVES (TA = 25°C)

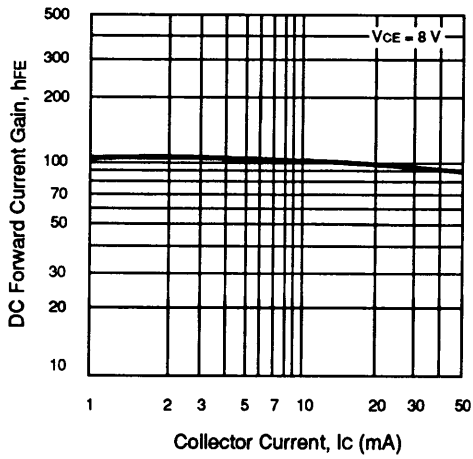
**DC POWER DERATING CURVES**



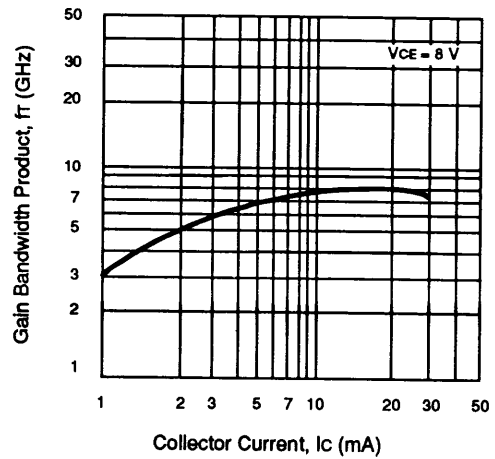
**COLLECTOR TO BASE CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE**



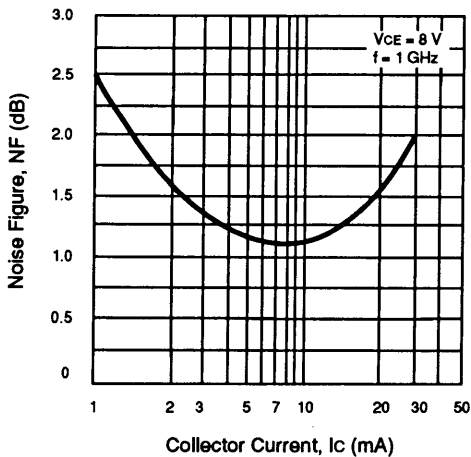
**FORWARD CURRENT GAIN vs. COLLECTOR CURRENT**



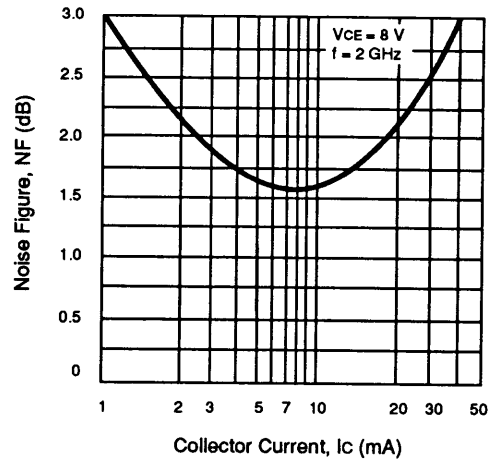
**GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT**



**NE68132 & NE68133 NOISE FIGURE vs. COLLECTOR CURRENT**

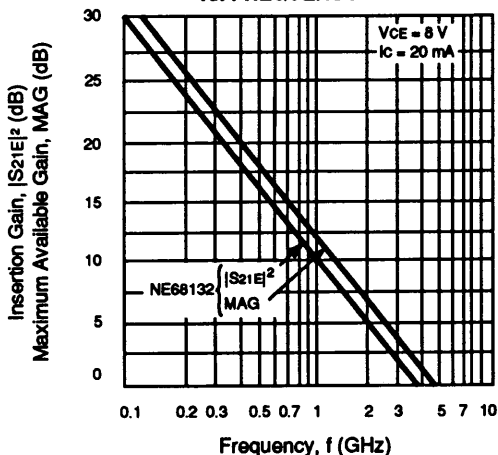


**NE68100 & NE68135 NOISE FIGURE vs. COLLECTOR CURRENT**

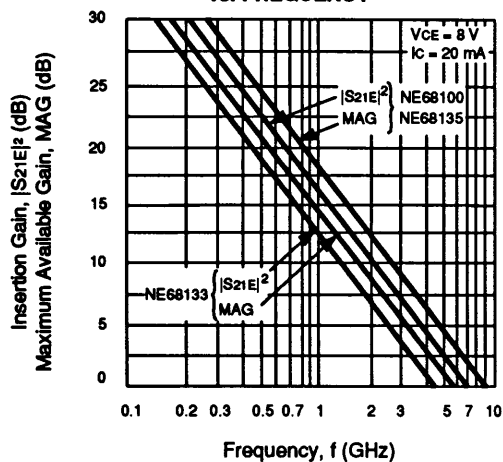


TYPICAL PERFORMANCE CURVES (TA = 25°C)

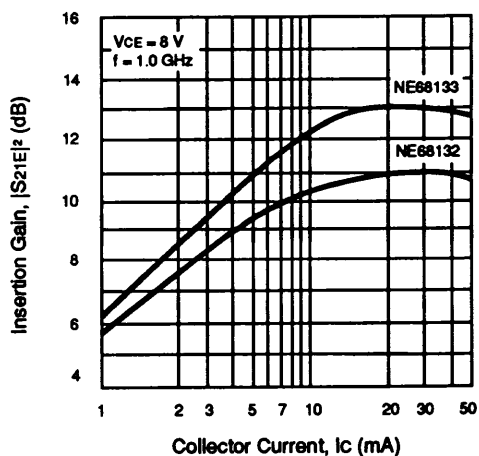
FORWARD INSERTION GAIN AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY



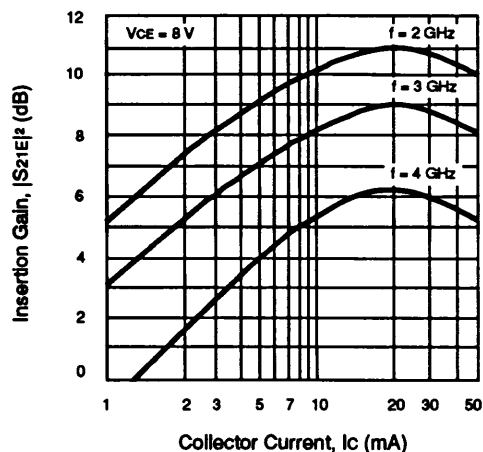
FORWARD INSERTION GAIN AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY



NE68132 & NE68133 INSERTION GAIN vs. COLLECTOR CURRENT



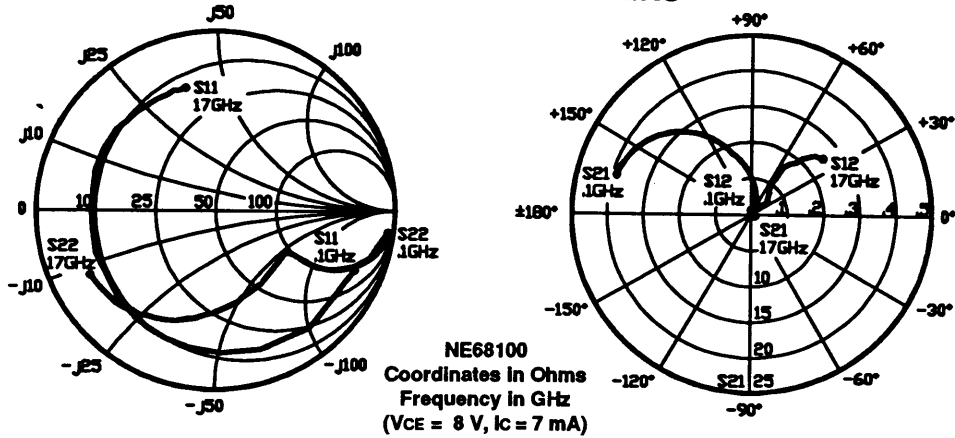
NE68100 & NE68135 INSERTION GAIN vs. COLLECTOR CURRENT



3

# NE681 SERIES

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68100  
VCE = 8 V, Ic = 7 mA  
FREQUENCY

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG <sup>†</sup> (dB)
0.1	0.827	-20.8	19.513	163.9	0.012	88.3	0.964	-7	0.03	32.1
0.2	0.809	-49.5	17.981	151	0.022	65.5	0.894	-16.8	0.13	29.1
0.5	0.742	-101.1	12.631	123	0.038	42.2	0.691	-27.4	0.28	25.2
1	0.701	-139.2	7.498	101.5	0.047	36.7	0.536	-29	0.47	22
1.5	0.689	-156.6	5.182	90.4	0.049	33	0.483	-28.6	0.71	20.2
2	0.686	-167.2	3.959	82	0.053	35	0.461	-29.2	0.88	18.7
3	0.687	179.8	2.687	69.7	0.061	45.9	0.447	-33.6	1.11	14.4
4	0.693	172.2	2.048	59.1	0.071	48.7	0.449	-40.6	1.21	11.8
5	0.699	166.6	1.662	49.8	0.081	53.2	0.454	-48	1.27	10
6	0.708	162.1	1.431	41.1	0.096	57	0.473	-57.1	1.15	9.4
7	0.717	157	1.25	31.7	0.116	56.6	0.49	-66.8	0.99	10.3
8	0.721	151.7	1.105	23.3	0.125	56.9	0.519	-76	0.97	9.5
9	0.725	145.5	0.989	14.2	0.146	55.9	0.549	-86.4	0.83	8.3
10	0.726	137.6	0.868	5.9	0.169	54.9	0.582	-96	0.74	7.1
11	0.724	131.2	0.773	-2	0.179	51.9	0.621	-104.8	0.71	6.4
12	0.722	123.6	0.673	-9.7	0.192	49	0.663	-114.1	0.69	5.4
13	0.728	117.1	0.569	-15.8	0.206	48	0.689	-122.4	0.71	4.4
14	0.725	112.2	0.49	-18.5	0.219	45.9	0.717	-130.2	0.76	3.5
16	0.715	104.9	0.365	-21.4	0.243	40.4	0.762	-145	0.92	1.8

VCE = 8 V, Ic = 20 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG <sup>†</sup> (dB)
0.1	0.665	-47	38.13	154.1	0.011	90	0.885	-15	0.01	35.4
0.2	0.664	-85.3	31.089	135.9	0.017	70.3	0.753	-26	0.12	32.6
0.5	0.663	-135.8	16.975	108.9	0.025	45.4	0.504	-30.8	0.45	28.3
1	0.663	-161.1	9.066	93.2	0.028	49.5	0.404	-27	0.82	25.1
1.5	0.667	-171.7	6.113	84.9	0.036	49.6	0.377	-26.3	0.97	22.3
2	0.669	-178.4	4.627	78.3	0.042	53.2	0.369	-26.6	1.1	18.5
3	0.676	172.7	3.112	67.9	0.054	59.2	0.361	-31.6	1.25	14.6
4	0.686	167.3	2.361	58.6	0.071	62.6	0.362	-38.5	1.21	12.5
5	0.693	162.6	1.913	50.1	0.086	63.5	0.372	-45.8	1.19	10.8
6	0.705	159	1.643	42.2	0.103	65.1	0.386	-55.5	1.08	10.3
7	0.719	154.5	1.433	33.3	0.123	63.2	0.405	-65	0.94	10.7
8	0.727	149.4	1.266	25.4	0.133	60.6	0.433	-74.2	0.91	9.8
9	0.726	143.5	1.134	16.7	0.153	60.4	0.464	-84.5	0.84	8.7
10	0.733	135.9	1.001	8.4	0.171	57.3	0.5	-94.4	0.76	7.7
11	0.732	129.4	0.897	0.5	0.185	53.9	0.546	-103.2	0.71	6.9
12	0.728	122.1	0.787	-7.1	0.197	51.8	0.587	-112.6	0.72	6
13	0.736	115.8	0.675	-13.4	0.212	50.3	0.624	-121	0.71	5
14	0.73	110.7	0.584	-17.8	0.229	46.3	0.655	-128	0.75	4.1
16	0.728	104.2	0.445	-22.2	0.252	41.7	0.717	-142.8	0.8	2.5
18	0.749	100.3	0.343	-22.2	0.276	38	0.75	-158.9	0.91	0.9

S-Parameters include bond wires.

BASE: Total 1 wire (s), 1 per bond pad, 0.0115 (291 μm) long each wire.

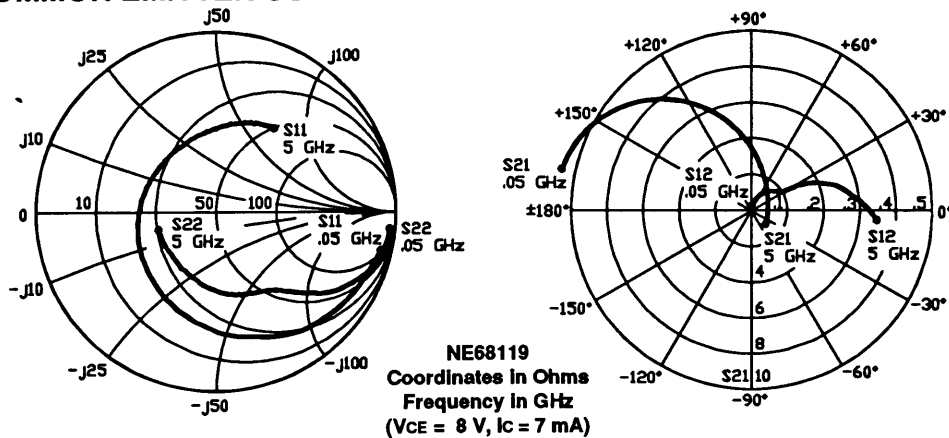
COLLECTOR: Total 1 wire (s), 1 per bond pad, 0.0072" (182 μm) long each wire.

EMITTER: Total 2 wire (s), 1 per side, 0.015" (393 μm) long each wire.

WIRE: 0.0007" (17.7 mm) dia., gold.

See note on next page.

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68119  
VCE = 2.5 V, IC = 0.3 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG <sup>1</sup> (dB)
0.05	0.995	-6.1	1.283	174.1	0.017	88.1	0.997	-1.1	0.02	18.8
0.1	0.992	-11.9	1.081	170.4	0.027	80.9	0.995	-4.5	0.06	16
0.2	0.981	-23.5	1.038	158.4	0.052	74	0.991	-9.3	0.11	13
0.3	0.967	-35.3	1.021	149.2	0.078	65	0.989	-14.3	0.15	11.2
0.4	0.95	-46.1	0.985	139.2	0.096	58.4	0.979	-18.2	0.2	10.1
0.5	0.929	-57	0.952	130	0.114	52.4	0.962	-22.5	0.23	9.2
0.6	0.915	-67	0.936	121	0.13	44.5	0.948	-26.4	0.3	8.6
0.7	0.892	-77	0.888	112.7	0.144	38.5	0.937	-30.1	0.33	7.9
0.8	0.874	-86	0.869	105	0.153	32.7	0.928	-33.9	0.36	7.5
0.9	0.853	-94.5	0.808	97.2	0.16	27.3	0.916	-37.1	0.42	7
1	0.838	-102.9	0.784	90.6	0.165	21.8	0.908	-40.5	0.45	6.8
1.5	0.77	-139.2	0.652	61.2	0.169	1.6	0.869	-54.5	0.66	5.9
2	0.723	-170.6	0.564	39	0.146	-12.7	0.842	-66.5	0.95	5.9
3	0.693	132.2	0.441	9	0.085	6	0.803	-91.2	1.98	1.5

VCE = 2.5 V, IC = 1.0 mA

0.05	0.979	-8.4	4.317	172.8	0.016	87.7	0.99	-1.3	0.04	24.3
0.1	0.965	-15.9	3.51	166.3	0.026	77.4	0.986	-7.5	0.1	21.3
0.2	0.944	-30	3.384	155.6	0.049	71.9	0.971	-13	0.09	18.4
0.3	0.915	-44.6	3.234	145.3	0.069	60.3	0.949	-19.4	0.15	16.7
0.4	0.877	-57.8	3.069	134.8	0.09	54.9	0.918	-24.6	0.17	15.3
0.5	0.836	-70.1	2.855	125.6	0.104	45.7	0.883	-29.1	0.25	14.4
0.6	0.802	-81.8	2.671	116.9	0.115	40.8	0.85	-33.4	0.28	13.7
0.7	0.77	-92.3	2.502	109	0.122	34.6	0.822	-37.2	0.33	13.1
0.8	0.741	-102	2.341	102	0.127	29.9	0.798	-40.6	0.38	12.7
0.9	0.714	-110.7	2.195	95.1	0.133	25.9	0.778	-43.4	0.43	12.2
1	0.694	-118.7	2.041	89.4	0.135	21.6	0.762	-46.4	0.48	11.8
1.5	0.616	-153.7	1.547	63.8	0.132	9.1	0.706	-58.1	0.75	10.7
2	0.572	177.3	1.255	43.4	0.124	6.7	0.672	-68.2	1.07	8.4
3	0.555	125.5	0.94	10.4	0.132	20.2	0.627	-89.7	1.41	4.7

VCE = 2.5 V, IC = 3 mA

0.05	0.937	-13	10.816	167.8	0.014	85.2	0.97	-5.3	0.08	28.9
0.1	0.904	-22.9	9.618	161.4	0.023	76.5	0.955	-12	0.1	26.2
0.2	0.839	-44.6	8.856	145.9	0.044	65.5	0.907	-21.5	0.16	23
0.3	0.771	-63.4	7.858	133	0.061	55.3	0.83	-29.5	0.25	21.1
0.4	0.699	-79.9	6.982	121.6	0.071	48.3	0.761	-35.9	0.32	19.9
0.5	0.642	-93.8	6.172	112.2	0.08	42.4	0.699	-39.7	0.41	18.9
0.6	0.598	-106	5.458	104.1	0.086	38.7	0.651	-43.3	0.48	18
0.7	0.564	-116.4	4.898	97.3	0.089	36.7	0.613	-46	0.55	17.4
0.8	0.534	-125.9	4.429	91.1	0.093	34	0.587	-48.2	0.62	16.8
0.9	0.511	-134.1	4.032	85.5	0.095	33.3	0.565	-50.1	0.69	16.3
1	0.494	-141.6	3.696	80.6	0.099	32.1	0.549	-52.3	0.74	15.7
1.5	0.438	-172.6	2.618	59.5	0.113	29.1	0.508	-59.9	0.99	13.6
2	0.409	162.4	2.042	41.8	0.13	28.7	0.485	-67.6	1.15	9.6
3	0.41	117	1.474	11.1	0.187	24.2	0.448	-85.5	1.16	6.5

Note:

1. Gain Calculations:

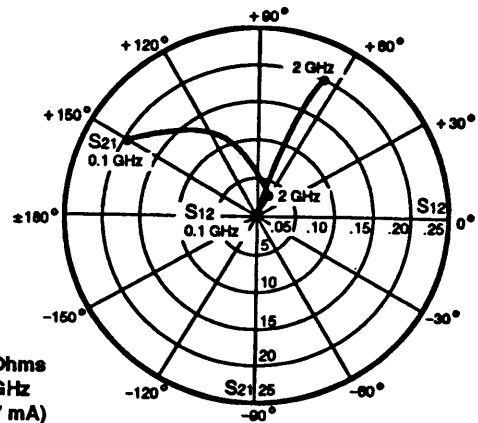
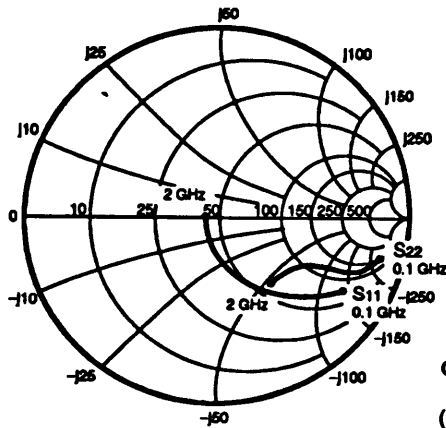
$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1})$$

When  $K \leq 1$ ,  $MAG = MSG$ .  $MSG = \frac{|S_{21}|}{|S_{12}|}$ ,  $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}$ ,  $\Delta = S_{11} S_{22} - S_{21} S_{12}$



# NE681 SERIES

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68133  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 8 V, IC = 7 mA)

NE68133

VCE = 8 V, IC = 7 mA

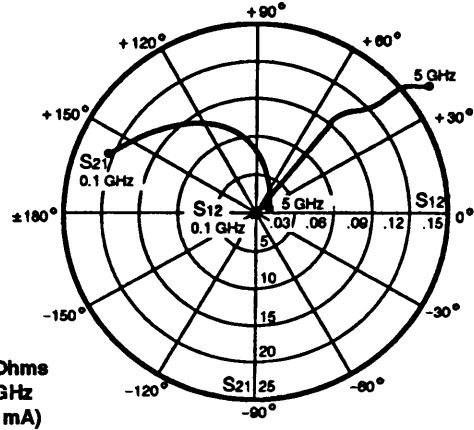
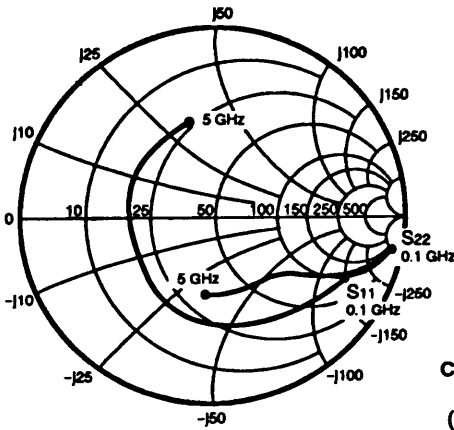
FREQUENCY (GHz)	S11	S21	S12	S22	K	MAG <sup>1</sup> (dB)
<b>VCE = 8 V, IC = 7 mA</b>						
0.1	0.802 -27.1	17.578 153.8	0.023 68.7	0.918 -12.7	0.37	28.8
0.2	0.639 -49.2	14.213 134.2	0.039 69.8	0.783 -19.9	0.46	25.6
0.5	0.344 -83.3	7.671 105.5	0.065 67.8	0.579 -21.5	0.81	20.7
1	0.17 -113.4	4.126 86.7	0.109 73.5	0.491 -17.7	1.01	15.2
1.5	0.115 -144.1	2.87 75.3	0.16 74.8	0.454 -17.8	1.05	11.2
2	0.098 -176.3	2.254 66.2	0.212 74.7	0.438 -16.9	1.04	9
3	0.137 137.6	1.669 53.2	0.313 73.2	0.409 -21	0.99	7.3
<b>VCE = 8 V, IC = 10 mA</b>						
0.1	0.744 -31.7	21.212 148.4	0.017 57.9	0.896 -14.6	0.5	31
0.2	0.553 -54.5	16.031 127.9	0.037 69	0.737 -21.7	0.54	26.4
0.5	0.277 -87.1	8.093 102	0.061 72.6	0.54 -20.9	0.88	21.2
1	0.134 -115.8	4.284 85.3	0.109 76.3	0.461 -17	1.04	14.7
1.5	0.092 -146.2	2.981 75.2	0.165 75.9	0.43 -16.5	1.04	11.3
2	0.079 180	2.35 66.5	0.217 75.2	0.413 -16.8	1.03	9.3
3	0.122 134.2	1.736 53.9	0.32 73.7	0.38 -21.3	0.99	7.3
<b>VCE = 8 V, IC = 20 mA</b>						
0.1	0.594 -43.3	29.285 138.1	0.013 61.2	0.792 -19.4	0.57	33.5
0.2	0.389 -66.3	19.28 117.5	0.035 73.1	0.614 -22.6	0.69	27.4
0.5	0.175 -95.5	8.683 96.1	0.057 74	0.481 -16.5	0.98	21.8
1	0.089 -127.5	4.512 82.3	0.11 79.6	0.44 -13.2	1.03	15.1
1.5	0.064 -160.8	3.078 73.3	0.167 78.9	0.416 -13.9	1.04	11.4
2	0.07 167	2.406 64.9	0.221 74.9	0.404 -13.8	1.02	9.5
3	0.12 132.5	1.774 53.1	0.322 72.4	0.379 -19.4	0.98	7.4
<b>VCE = 8 V, IC = 30 mA</b>						
0.1	0.557 -46.9	30.197 135.2	0.017 65.9	0.836 -17.4	0.5	32.5
0.2	0.354 -70.7	19.196 115.1	0.029 73.4	0.664 -22.2	0.67	28.2
0.5	0.158 -100.5	8.499 94.8	0.059 77.7	0.503 -17.7	0.95	21.6
1	0.08 -136.1	4.363 81.7	0.111 80.7	0.455 -14.3	1.03	14.9
1.5	0.065 -175	3.009 72.7	0.167 80.1	0.428 -14.2	1.03	11.5
2	0.076 156	2.348 65	0.219 77.1	0.415 -14.2	1.03	9.2
3	0.127 128.4	1.742 53	0.325 74.2	0.387 -19.7	0.98	7.3

Note:

1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1}) \quad \text{When } K \leq 1, MAG = MSG. \quad MSG = \frac{|S_{21}|}{|S_{12}|}, \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \quad \Delta = S_{11} S_{22} - S_{21} S_{12}$$

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68135  
Coordinates in Ohms  
Frequency in GHz  
(VCE = V, IC = 7 mA)

NE68135

VCE = 8V, IC = 7 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG <sup>1</sup> (dB)
<b>VCE = 8 V, IC = 7 mA</b>										
0.1	0.81	-23	16.36	165	0.005	152	0.96	-8	-0.55	35.1
0.5	0.61	-99	11.02	118	0.02	49	0.66	-31	0.73	27.4
1	0.51	-141	6.44	91	0.03	42	0.51	-37	1.34	19.8
1.5	0.46	-165	4.43	76	0.04	43	0.52	-41	1.52	16.2
2	0.45	177	3.45	64	0.05	43	0.48	-44	1.67	13.6
3	0.5	146	2.35	43	0.1	43	0.46	-60	1.15	11.4
4	0.53	124	1.82	23	0.13	40	0.45	-78	1.1	9.5
5	0.55	105	1.47	5	0.16	36	0.48	-94	1.03	8.6
<b>VCE = 8 V, IC = 10 mA</b>										
0.1	0.75	-27	20.42	162	0.004	153	0.96	-10	-0.46	37.1
0.5	0.56	-109	12.44	114	0.01	51	0.6	-33	1.63	26.3
1	0.48	-149	7	89	0.02	46	0.47	-37	2.04	19.6
1.5	0.44	-171	4.78	75	0.04	48	0.48	-40	1.53	16.5
2	0.43	171	3.71	63	0.05	47	0.44	-44	1.68	13.9
3	0.47	143	2.52	43	0.1	48	0.42	-59	1.2	11.3
4	0.51	122	1.95	24	0.13	43	0.42	-78	1.13	9.6
5	0.53	104	1.57	6	0.17	36	0.43	-95	1.04	8.4
<b>VCE = 8 V, IC = 20 mA</b>										
0.1	0.65	-37	28.32	157	0.006	154	0.93	-13	-0.29	36.7
0.5	0.49	-127	14.25	107	0.01	56	0.52	-34	1.81	26.3
1	0.44	-161	7.66	86	0.01	56	0.41	-36	4.25	19.6
1.5	0.42	-180	5.15	73	0.03	56	0.43	-39	2.07	16.5
2	0.41	164	3.99	61	0.05	54	0.4	-42	1.69	14.2
3	0.46	138	2.7	42	0.11	51	0.38	-58	1.11	11.9
4	0.5	118	2.07	24	0.14	44	0.39	-77	1.07	10.1
5	0.53	101	1.68	7	0.17	37	0.41	-93	1.01	9.3
<b>VCE = 8 V, IC = 30 mA</b>										
0.1	0.6	-44	31.85	154	0.004	153	0.91	-14	-0.05	39
0.5	0.47	-137	14.38	104	0.007	62	0.49	-31	2.78	25.8
1	0.45	-167	7.6	84	0.01	61	0.41	-33	4.22	19.6
1.5	0.43	176	5.09	72	0.03	59	0.43	-37	2.07	16.4
2	0.42	161	3.94	61	0.05	57	0.41	-41	1.67	14.2
2.5	0.46	146	3.12	52	0.09	56	0.39	-49	1.15	13
3	0.48	137	2.67	42	0.11	54	0.39	-58	1.08	12.1
3.5	0.49	126	2.29	31	0.12	49	0.39	-66	1.13	10.6
4	0.51	117	2.05	24	0.14	46	0.4	-76	1.05	10.3
4.5	0.52	108	1.8	17	0.16	44	0.4	-84	1.04	9.3
5	0.53	100	1.66	7	0.17	39	0.41	-93	1.03	8.8

Note:

1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1})$$

. When  $K \leq 1$ ,  $MAG = MSG$ .  $MSG = \frac{|S_{21}|}{|S_{12}|}$ ,  $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}$ ,  $\Delta = S_{11} S_{22} - S_{21} S_{12}$



# NE681 SERIES

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS

V<sub>CE</sub> = 2.5 V, I<sub>C</sub> = 0.3 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG <sup>1</sup> (dB)
0.05	0.996	-3.4	1.089	175.2	0.014	83.2	0.995	-1.1	0.13	18.9
0.1	0.995	-11.4	1.079	173.1	0.027	80.3	0.993	-2.7	0.06	16
0.2	0.99	-20.3	1.071	161.9	0.05	74.5	0.989	-5.7	0.16	13.3
0.3	0.973	-30.7	1.032	153.6	0.075	68.7	0.985	-8.7	0.19	11.4
0.4	0.953	-41.2	0.993	145.9	0.098	64.3	0.976	-11.4	0.19	10.1
0.5	0.931	-50.3	0.991	137.2	0.122	59.3	0.965	-13.8	0.25	9.1
0.6	0.909	-60.5	1.008	129.9	0.138	53.5	0.949	-16.4	0.28	8.6
0.8	0.862	-79.9	0.908	114.3	0.167	42.7	0.918	-21	0.37	7.4
1	0.819	-98.5	0.871	101.2	0.184	33.4	0.888	-25	0.45	6.8
1.5	0.744	-140	0.729	72.2	0.192	14.1	0.828	-35.2	0.66	5.8
2	0.732	-173	0.632	51.7	0.155	3.4	0.802	-46.3	0.85	6.1
3	0.762	142.1	0.438	28.5	0.089	38.4	0.77	-76.7	1.62	2.3

V<sub>CE</sub> = 2.5 V, I<sub>C</sub> = 1.0 mA

0.05	0.985	-6.8	3.763	175.3	0.016	86.4	0.989	-2.8	0.01	23.7
0.1	0.971	-14.8	3.648	171	0.029	82.4	0.98	-4.8	0.01	21
0.2	0.942	-27.5	3.497	159.1	0.05	74.3	0.963	-9.5	0.1	18.4
0.3	0.914	-40.4	3.346	149.4	0.07	65.4	0.946	-13.9	0.17	16.8
0.4	0.876	-53.8	3.184	140.6	0.092	58.7	0.916	-17.8	0.2	15.4
0.5	0.828	-65.2	3.043	131.8	0.106	53.8	0.884	-20.9	0.25	14.6
0.6	0.79	-76.9	2.88	124.1	0.119	47.7	0.845	-24.1	0.3	13.8
0.8	0.715	-98.4	2.516	109.8	0.137	38.9	0.778	-28.6	0.4	12.6
1	0.663	-117.6	2.237	98.4	0.145	32.3	0.726	-31.9	0.49	11.9
1.5	0.596	-157.8	1.686	74.8	0.145	23.5	0.631	-39.8	0.75	10.7
2	0.6	173.8	1.346	56.9	0.13	24.6	0.583	-48.9	1.04	8.9
3	0.66	136.9	0.941	30.9	0.144	47.4	0.538	-75.9	1.21	5.4

V<sub>CE</sub> = 2.5 V, I<sub>C</sub> = 3 mA

0.05	0.916	-10.7	10.426	172.1	0.015	84.7	0.975	-4.6	0.07	28.4
0.1	0.895	-23.5	9.954	164.8	0.027	79	0.972	-9.6	0.05	25.7
0.2	0.829	-42	9.011	148.6	0.046	67.6	0.91	-18.1	0.19	22.9
0.3	0.755	-60.3	8.067	136.2	0.061	57.7	0.826	-24.5	0.29	21.2
0.4	0.694	-76.4	7.165	125.8	0.074	52.4	0.754	-29.3	0.35	19.9
0.5	0.619	-90	6.329	117.1	0.083	49.8	0.69	-32.3	0.43	18.8
0.6	0.574	-103	5.66	109.8	0.089	46.7	0.634	-34.4	0.5	18
0.8	0.5	-125	4.558	97.8	0.099	43.3	0.552	-37.1	0.65	16.6
1	0.47	-143.4	3.815	88.7	0.106	42	0.496	-38.6	0.77	15.6
1.5	0.453	-178.4	2.684	70.7	0.123	43.6	0.412	-43.3	0.99	13.4
2	0.481	159.4	2.078	56.4	0.141	47.3	0.362	-51.3	1.11	9.7
3	0.567	130.6	1.442	34.1	0.197	49.7	0.302	-78.6	1.08	6.9

V<sub>CE</sub> = 8 V, I<sub>C</sub> = 7 mA

0.1	0.764	-28	17.806	156	0.002	53	0.944	-12	0.91	39.5
0.2	0.675	-55	15.233	138	0.008	70	0.855	-19	0.54	32.8
0.3	0.569	-76	12.659	126	0.018	61	0.734	-22	0.69	28.5
0.4	0.481	-94	10.62	116	0.025	59	0.698	-25	0.74	26.3
0.5	0.432	-110	8.886	107	0.035	59	0.602	-24	0.86	24
0.6	0.398	-120	7.696	102	0.043	58	0.589	-24	0.86	22.5
0.7	0.374	-133	6.888	97	0.046	59	0.53	-26	0.99	21.8
0.8	0.354	-141	6.073	93	0.056	59	0.522	-25	0.97	20.4
0.9	0.339	-152	5.422	88	0.055	60	0.493	-28	1.13	17.7
1	0.332	-159	4.963	85	0.066	61	0.493	-25	1.05	17.4
1.1	0.333	-166	4.576	81	0.069	62	0.488	-28	1.08	16.5
1.2	0.343	-174	4.264	78	0.076	62	0.457	-27	1.09	15.7
1.3	0.332	180	3.912	76	0.08	63	0.467	-29	1.12	14.8
1.4	0.343	173	3.656	73	0.089	63	0.449	-29	1.09	14.3
1.5	0.348	171	3.433	71	0.098	66	0.447	-29	1.06	13.9
2	0.414	150	2.656	56	0.129	60	0.388	-40	1.04	11.9
3	0.502	126	1.829	38	0.192	60	0.323	-63	1	9.8
4	0.595	110	1.426	17	0.256	50	0.302	-95	0.88	7.5
5	0.65	97	1.119	1	0.317	44	0.343	-126	0.83	5.5

Note:

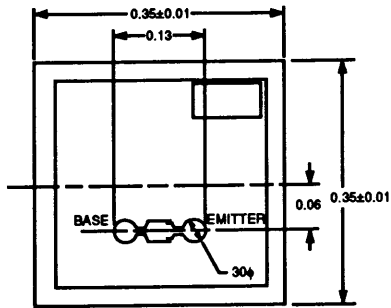
1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1}) \quad \text{When } K \leq 1, MAG = MSG. \quad MSG = \frac{|S_{21}|}{|S_{12}|}, \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \quad \Delta = S_{11} S_{22} - S_{21} S_{12}$$

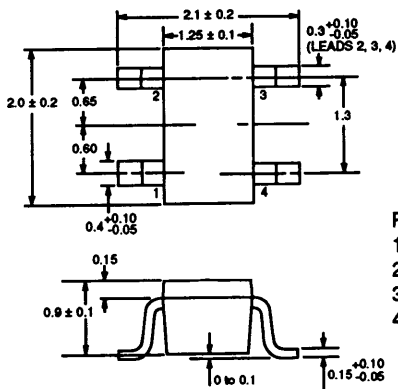
**OUTLINE DIMENSIONS** (Units in mm)

**NE68000 (CHIP)**

(Chip Thickness: 160 μm)



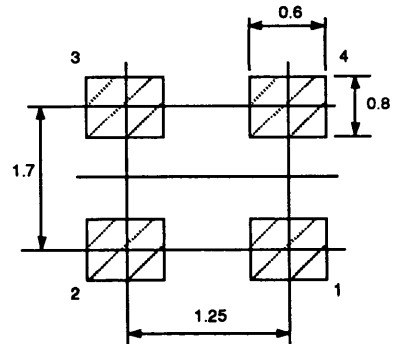
**PACKAGE OUTLINE 18**



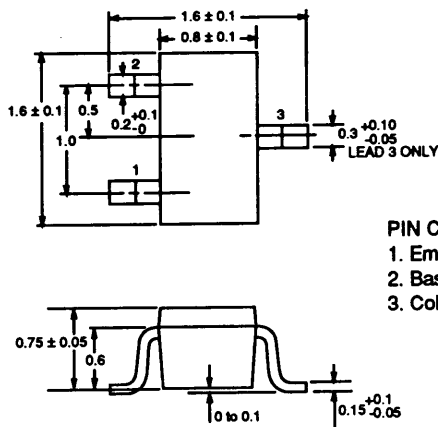
**PIN CONNECTIONS**

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

**PACKAGE OUTLINE 18  
RECOMMENDED P.C.B. LAYOUT**



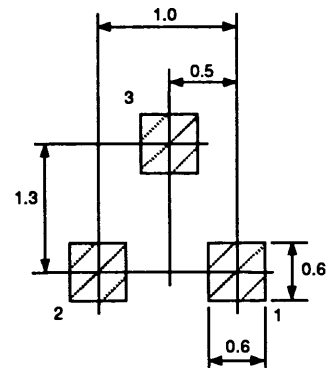
**PACKAGE OUTLINE 19**



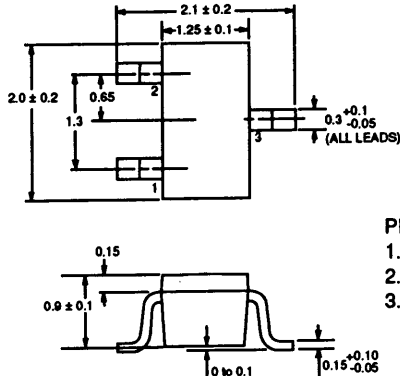
**PIN CONNECTIONS**

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

**PACKAGE OUTLINE 19  
RECOMMENDED P.C.B. LAYOUT**



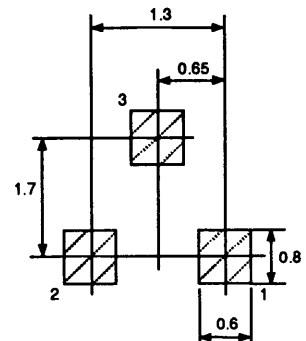
**PACKAGE OUTLINE 30**



**PIN CONNECTIONS**

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

**PACKAGE OUTLINE 30  
RECOMMENDED P.C.B. LAYOUT**

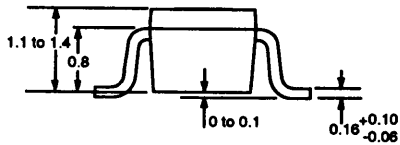
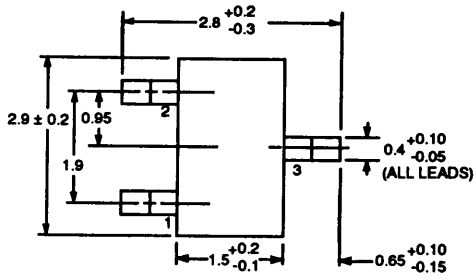


3

# NE681 SERIES

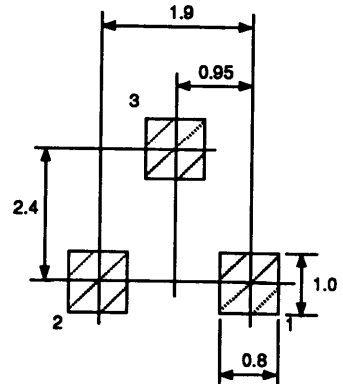
## OUTLINE DIMENSIONS (Units in mm)

**PACKAGE OUTLINE 33  
(SOT-23)**

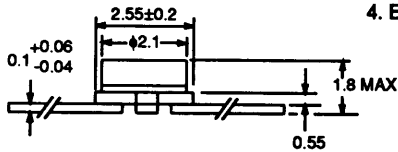
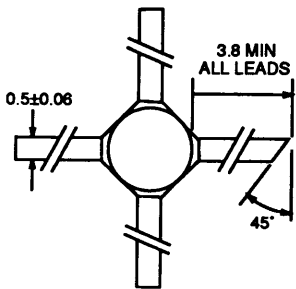


- PIN CONNECTIONS**  
 1. Emitter  
 2. Base  
 3. Collector

**PACKAGE OUTLINE 33  
RECOMMENDED P.C.B. LAYOUT**

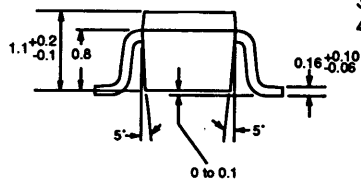
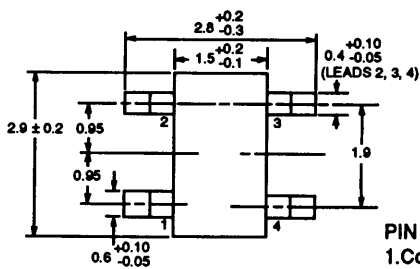


**PACKAGE OUTLINE 35  
(MICRO-X)**



- PIN CONNECTIONS**  
 1. Collector  
 2. Emitter  
 3. Base  
 4. Emitter

**PACKAGE OUTLINE 39**



- PIN CONNECTIONS**  
 1. Collector  
 2. Emitter  
 3. Base  
 4. Emitter

**PACKAGE OUTLINE 39  
RECOMMENDED P.C.B. LAYOUT**

