



# NPN SILICON HIGH FREQUENCY TRANSISTOR

# NE021 SERIES

T-31-19

## FEATURES

- HIGH INSERTION GAIN: 18.5 dB at 500 MHz
- LOW NOISE FIGURE: 1.5 dB at 500 MHz
- HIGH POWER GAIN: 12 dB at 2 GHz
- LARGE DYNAMIC RANGE: 19 dBm at 1 dB 2 GHz Gain Compression

## DESCRIPTION AND APPLICATIONS

The NE021 series of NPN silicon transistors provides economical solutions to wide ranges of amplifier and oscillator problems. Low noise and high current capability provide wide dynamic ranges; the excellent linearity of S<sub>21</sub> with collector current assures low intermodulation distortion. The NE021 series is available as a chip or in several package styles. The series uses the NEC gold, platinum, titanium, and platinum-silicide metallization system to provide the utmost in reliability. Most package options are available with Grade C (JANTXV equivalent) and Grade CX (JANTX equivalent) reliability screening. Some packages are available in both common-base and common-emitter configurations. The NE02103 and the NE02107 have been qualified for high-reliability space applications.

## ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub>	Collector to Base Voltage	V	25
V <sub>CE0</sub>	Collector to Emitter Voltage	V	12 <sup>1</sup>
V <sub>EB0</sub>	Emitter to Base Voltage	V	3
I <sub>C</sub>	Collector Current	mA	70
T <sub>J</sub>	Junction Temperature	°C	200 <sup>2</sup>
T <sub>STG</sub>	Storage Temperature	°C	-65 to +200 <sup>3</sup>

### Notes:

1. Typical BV<sub>CEB</sub> = 25 V for R ≤ 300 Ω.
2. Maximum T<sub>J</sub> for the NE02132, NE02133, NE02136, and NE02137 is +150°C.
3. Maximum storage temperature for the NE02132, NE02135, NE02136 and NE02137 is -65 to +150°C. Maximum storage temperature for the NE02133 is -55 to +150°C.

## NE02135 TYPICAL NOISE PARAMETERS

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 5 mA

FREQUENCY (MHz)	NF <sub>min</sub> (dB)	G <sub>A</sub>	OPT SOURCE	R <sub>N</sub> /50 Ω
500	1.2	18.6	.36 ∠ 69°	.14
1000	1.5	13.9	.31 ∠ 124°	.12
1500	2.0	12.1	.50 ∠ 165°	.05
2000	2.4	9.6	.44 ∠ -175°	.06
2500	2.6	8.9	.52 ∠ -161°	.10
3000	3.6	8.6	.68 ∠ -141°	.14
3500	3.7	6.9	.71 ∠ -139°	.21

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 20 mA

500	1.8	20.6	.16 ∠ 149°	.15
1000	1.9	16.1	.33 ∠ 169°	.13
1500	2.4	13.5	.46 ∠ -179°	.09
2000	2.9	11.5	.53 ∠ -167°	.08
2500	3.2	9.8	.57 ∠ -154°	.14
3000	3.9	9.7	.62 ∠ -139°	.27
3500	4.3	7.6	.67 ∠ -134°	.42

**PERFORMANCE SPECIFICATIONS (TA = 25°C)**

SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	NE02100 00 (CHIP)			NE02103 2SC1560(C) 03			NE02107 07			NE02112 2SC1988 12			NE02132 2SC2570 32			NE02133 2SC2351 33			NE02135 2SC2149 35			NE02137 2SC2369 37		
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f <sub>r</sub>	Gain Bandwidth Product at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA	GHz		4.5				4.5						4.5												4.5
S <sub>21</sub>   <sup>2</sup>	Insertion Power Gain at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA, f = 0.5 GHz	dB		18.5				18.5						15												18.5
	f = 1 GHz	dB		13				13						10												13
	f = 2 GHz	dB	5.5	6.5			5.5	6.5					5.5	6.5											5	5.7
NF <sub>MIN</sub>	Minimum Noise Figure <sup>2</sup> at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 3 mA, f = 0.5 GHz	dB		1.5				1.5						1.5	2.5											1.5
	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5 mA, f = 1 GHz	dB		2.7	4.5		2.7	4.5						2.7	4.5											2.7
	f = 2 GHz	dB		2.7	4.5		2.7	4.5						2.7	4.5											2.7
MAG	Maximum Available Gain <sup>3</sup> at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA, f = 0.5 GHz	dB		22				22						17.5												22
	f = 1 GHz	dB		18				18						12.5												18
	f = 2 GHz	dB		12				12						7.5												11

Notes:

1. Electronic Industrial Association of Japan.
2. Input and output are tuned for optimum noise figures.
3. Maximum Available Gain (MAG) is calculated for the device S-Parameters using the equation,  $MAG = |S_{21}|^2 \cdot \frac{1}{1 - |S_{11}|^2} \cdot \frac{1}{1 - |S_{22}|^2}$

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

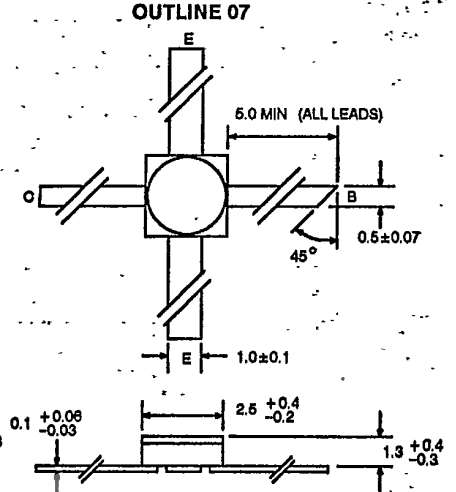
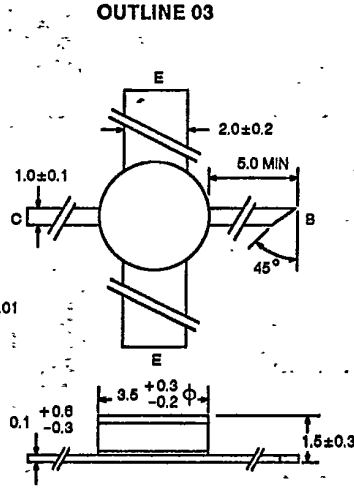
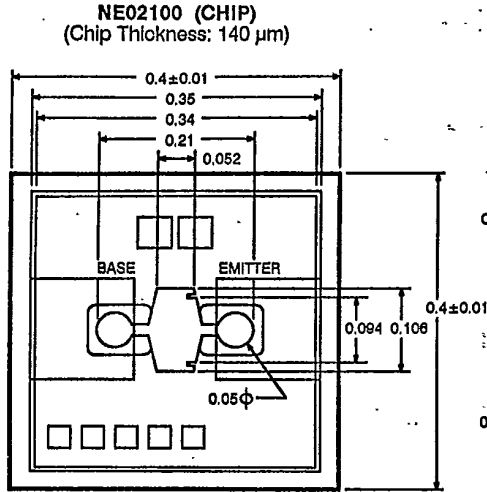
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	NE02100 00 (CHIP)			NE02103 2SC1560(C) 03			NE02107 07			NE02112 2SC1988 12			NE02132 2SC2570 32			NE02133 2SC2351 33			NE02135 2SC2149 35			NE02137 2SC2369 37		
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I <sub>CEO</sub>	Collector Cutoff Current at V <sub>CB</sub> = 15 V, I <sub>E</sub> = 0	μA		1.0				1.0						1.0												1.0
I <sub>EO</sub>	Emitter Cutoff Current at V <sub>EB</sub> = 2 V, I <sub>C</sub> = 0	μA		1.0				1.0						1.0												1.0
I <sub>FE</sub>	Forward Current Gain at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA		20	70	250	20	70	250	20	70	250	20	70	250	20	70	250	40	70	200	20	70	250	20	70	250
C <sub>cb</sub>	Collector to Base Capacitance <sup>2</sup> at V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, f = 1 MHz	pF		0.6	1.0		0.6	1.0		0.6	1.0		0.6	0.9											0.6	1.0
R <sub>th</sub>	Thermal Resistance (J-C)	°C/W		70			70			90			90												120	1.0
R <sub>th</sub>	Thermal Resistance (J-A)						300			500			500												600	500
P <sub>T</sub> <sup>3</sup>	Total Power Dissipation	mW	580		700	580	700	350	700	350	700	350	700	250	250	290	500	150	290	666	150	290	500	500	500	250

Notes:

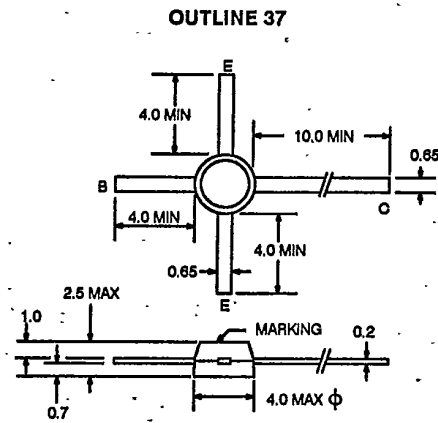
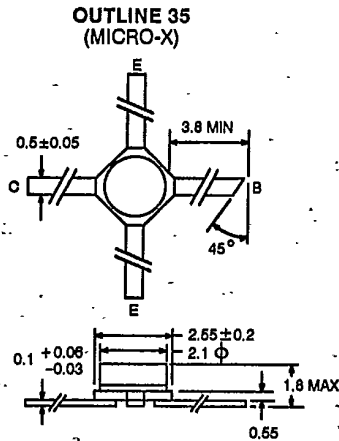
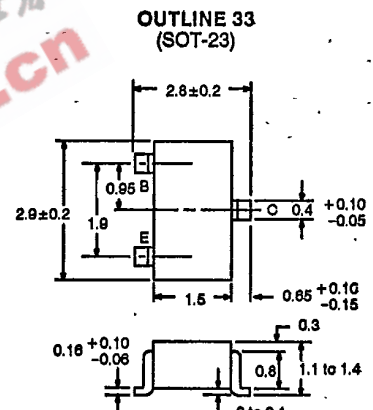
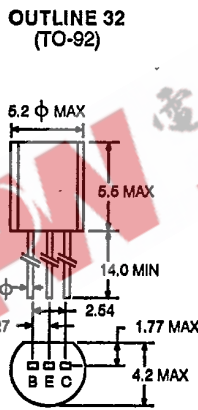
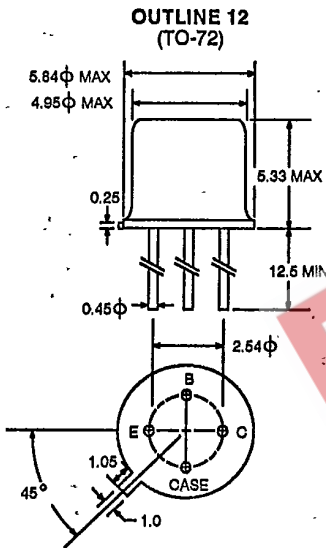
1. Electronic Industrial Association of Japan.
2. C<sub>cb</sub> measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.
3. Minimum dissipation based on R<sub>th</sub>(J-A) for applications without effective heatsink, maximum dissipation based on R<sub>th</sub>(J-C) for applications with effective heatsink.



OUTLINE DIMENSIONS (Units in mm)



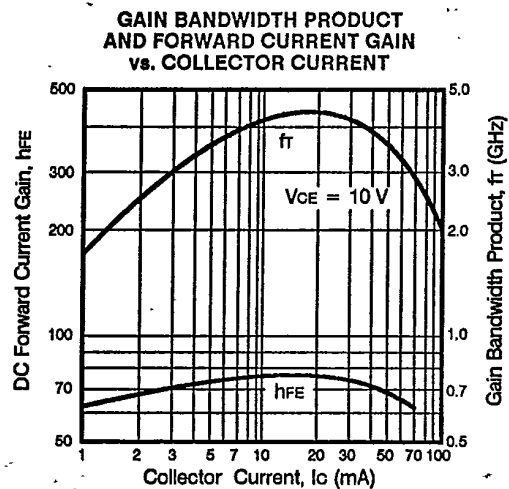
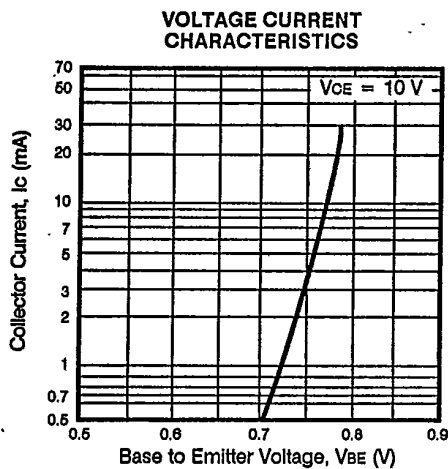
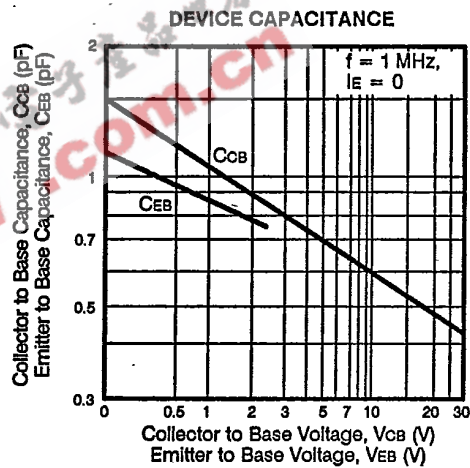
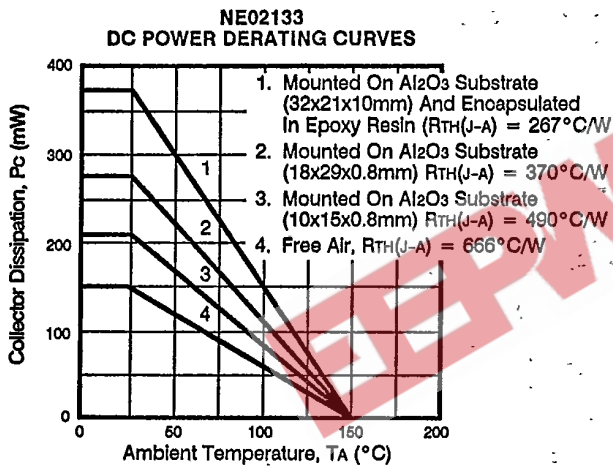
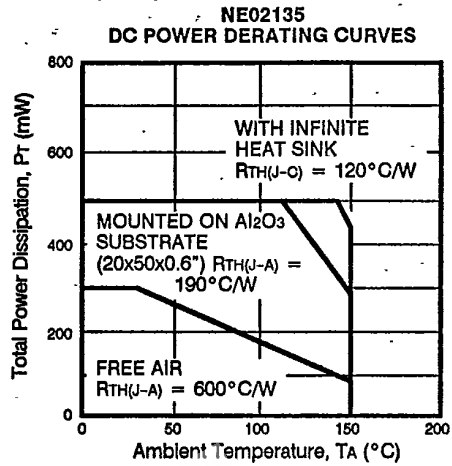
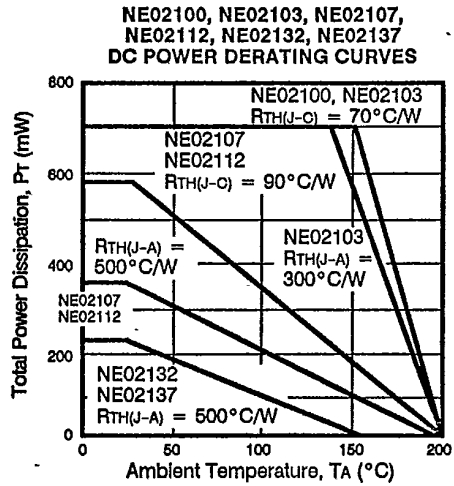
\*07B has emitter and base reversed.



\*The NE02136 is available with only the bottom emitter lead.

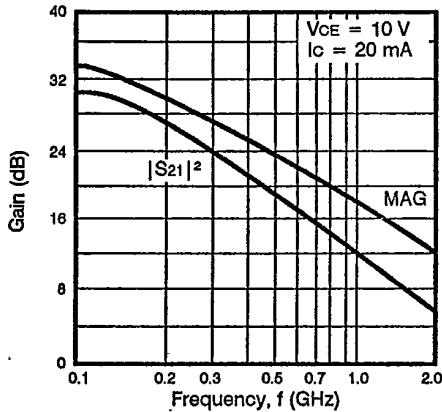
T-31-17  
T-31-19

TYPICAL DEVICE CHARACTERISTICS (TA = 25°C)

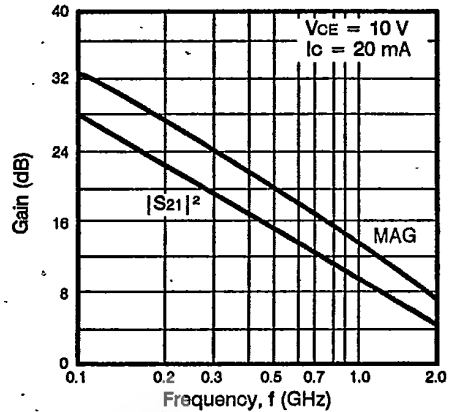


TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)

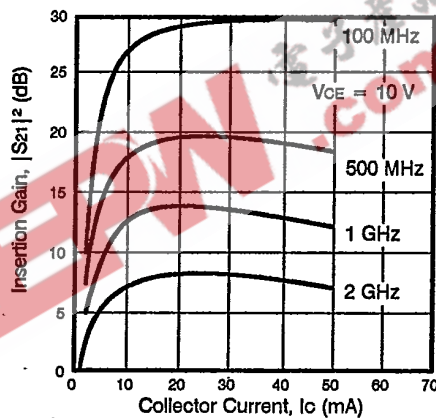
NE02103, NE02107, NE02135  
GAIN vs. FREQUENCY



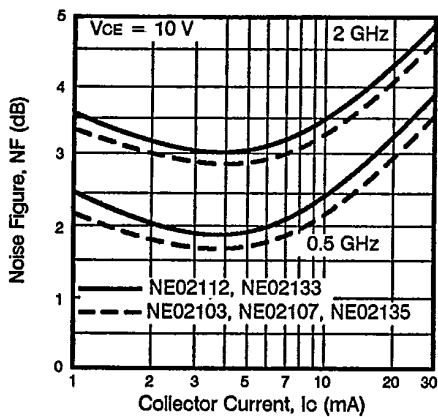
NE02112, NE02133  
GAIN vs. FREQUENCY



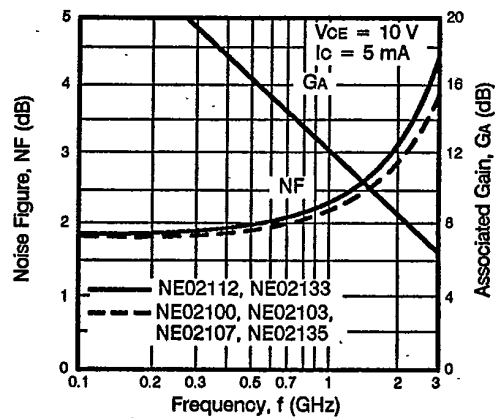
NE02103, NE02107  
INSERTION GAIN vs. COLLECTOR CURRENT



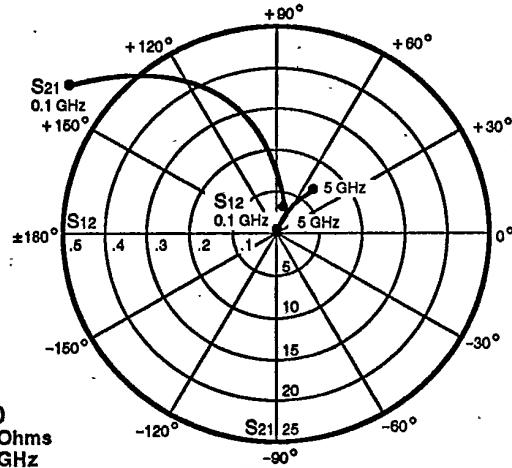
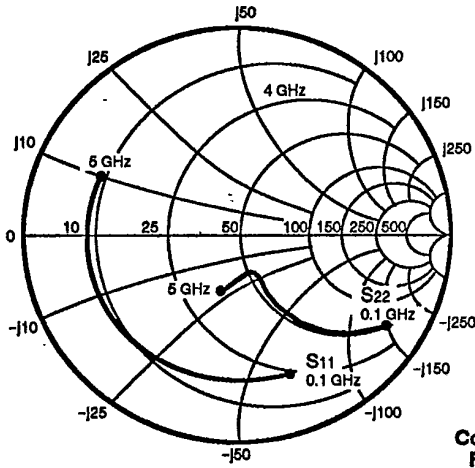
NOISE FIGURE vs.  
COLLECTOR CURRENT



NOISE FIGURE AND ASSOCIATED  
GAIN vs. FREQUENCY



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02100  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

FREQUENCY (MHz)	S11	S21	S12	S22	k	GMA dB
100	.84 -32	11.83 160	.03 70	.94 -16	.11	26.4
500	.75 -114	7.22 113	.07 36	.56 -45	.29	19.9
1000	.73 -150	4.13 89	.09 27	.39 -51	.54	16.9
1500	.71 -164	2.85 76	.09 27	.35 -56	.77	15.0
2000	.71 -173	2.16 66	.10 28	.33 -61	.97	13.5
2500	.71 -179	1.75 57	.10 30	.33 -67	1.14	10.1
3000	.70 176	1.49 49	.11 32	.34 -73	1.25	8.3
3500	.70 172	1.28 42	.12 33	.35 -80	1.35	6.9
4000	.70 168	1.13 34	.12 34	.37 -88	1.41	5.9
4500	.70 165	1.02 27	.13 34	.39 -94	1.47	4.9
5000	.70 161	.92 20	.14 35	.41 -100	1.49	4.2

VCE = 10 V, IC = 10 mA

100	.75 -47	20.04 153	.02 65	.89 -24	.11	29.2
500	.72 -137	9.40 105	.05 34	.41 -57	.39	22.5
1000	.72 -162	4.97 86	.06 34	.27 -62	.69	19.0
1500	.71 -173	3.37 75	.07 38	.23 -66	.92	16.8
2000	.71 -179	2.56 66	.08 41	.22 -71	1.09	13.2
2500	.71 176	2.05 58	.09 43	.23 -76	1.19	10.9
3000	.71 172	1.74 51	.10 44	.24 -82	1.27	9.2
3500	.71 168	1.50 44	.11 44	.25 -88	1.31	7.9
4000	.70 165	1.33 37	.12 44	.27 -95	1.36	6.8
4500	.70 162	1.19 30	.13 44	.29 -100	1.39	5.9
5000	.70 159	1.08 24	.14 43	.31 -106	1.39	5.1

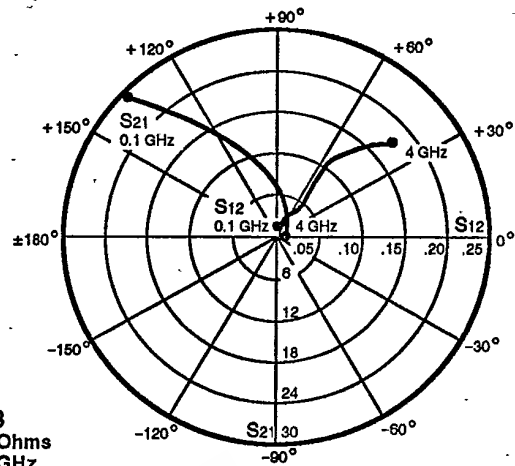
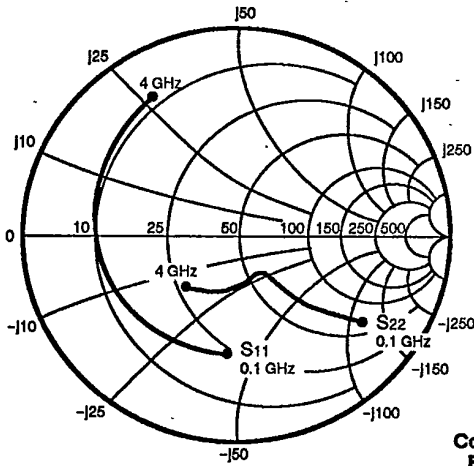
VCE = 10 V, IC = 20 mA

100	.68 -70	29.75 145	.02 59	.81 -33	.14	31.6
500	.72 -152	10.58 99	.04 37	.30 -65	.53	24.3
1000	.72 -170	5.42 84	.05 43	.19 -69	.87	20.4
1500	.72 -178	3.65 74	.06 48	.17 -73	1.05	16.4
2000	.72 177	2.74 66	.07 50	.17 -78	1.17	13.2
2500	.72 172	2.21 58	.09 51	.17 -83	1.23	11.3
3000	.71 169	1.86 51	.10 52	.19 -87	1.27	9.7
3500	.71 166	1.61 44	.11 51	.20 -93	1.30	8.4
4000	.71 162	1.42 38	.12 51	.22 -99	1.34	7.3
4500	.71 160	1.28 31	.13 49	.24 -105	1.33	6.4
5000	.71 157	1.15 25	.14 48	.27 -109	1.34	5.6

NOTE: 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 μm) dia., gold.



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02103  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)	S11	S21	S12	S22
100	.82 -41	13.67 154	.02 72	.92 -17
500	.67 -133	6.53 103	.07 34	.51 -43
1000	.66 -167	3.58 79	.08 31	.38 -51
1500	.65 175	2.45 63	.10 32	.37 -61
2000	.66 163	1.85 51	.11 36	.37 -71
2500	.67 151	1.49 38	.12 34	.36 -83
3000	.68 141	1.29 26	.14 35	.38 -98
3500	.69 132	1.09 16	.16 32	.40 -110
4000	.71 124	.96 5	.16 29	.43 -121

VCE = 10 V, IC = 10 mA

100	.69 -62	21.74 145	.01 68	.84 -25
500	.65 -154	7.92 96	.05 39	.36 -49
1000	.65 -179	4.15 76	.07 43	.27 -55
1500	.65 168	2.81 62	.08 47	.27 -63
2000	.66 158	2.12 51	.11 49	.28 -74
2500	.68 146	1.70 39	.12 44	.28 -88
3000	.69 138	1.46 28	.14 43	.30 -102
3500	.71 129	1.23 17	.17 40	.33 -115
4000	.72 121	1.09 7	.17 34	.35 -126

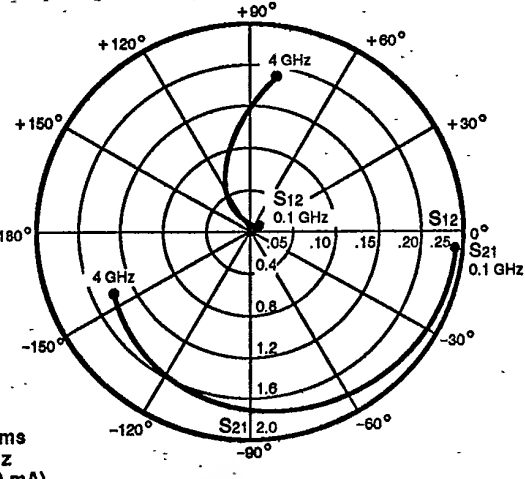
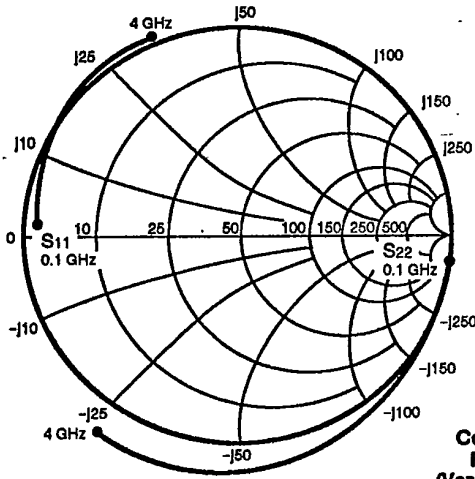
VCE = 10 V, IC = 20 mA

100	.57 -91	29.51 136	.01 65	.74 -33
500	.65 -167	8.77 91	.04 48	.27 -54
1000	.66 175	4.49 74	.06 54	.20 -60
1500	.66 164	3.05 61	.08 54	.21 -68
2000	.68 154	2.27 51	.10 55	.22 -78
2500	.69 144	1.83 39	.13 50	.23 -93
3000	.70 136	1.56 29	.14 45	.25 -107
3500	.72 127	1.30 19	.16 42	.28 -118
4000	.74 120	1.18 9	.18 39	.31 -130

VCE = 10 V, IC = 40 mA

100	.53 -121	34.50 128	.01 66	.66 -38
500	.66 -175	9.00 88	.03 61	.23 -50
1000	.67 171	4.66 72	.05 63	.17 -55
1500	.68 161	3.07 60	.08 59	.19 -64
2000	.69 152	2.30 50	.10 60	.21 -75
2500	.71 142	1.85 39	.13 54	.21 -92
3000	.72 135	1.59 29	.14 47	.24 -108
3500	.74 126	1.33 19	.16 45	.26 -119
4000	.75 119	1.18 8	.17 42	.30 -131

**TYPICAL COMMON BASE SCATTERING PARAMETERS**



**NE02107B**  
Coordinates in Ohms  
Frequency in GHz  
(V<sub>CB</sub> = 10 V, I<sub>C</sub> = 20 mA)

**S-MAGN AND ANGLES:**

V<sub>CB</sub> = 10 V, I<sub>C</sub> = 5 mA

FREQUENCY (MHz)

	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
100	.79	175	1.77	-10	.01	106	1.01	-9
500	.79	170	1.78	-24	.01	111	1.02	-22
1000	.79	163	1.72	-44	.01	117	1.05	-40
1500	.83	157	1.71	-64	.03	109	1.09	-58
2000	.83	149	1.57	-87	.06	106	1.09	-75
2500	.87	145	1.53	-99	.08	103	1.08	-81
3000	.87	136	1.40	-122	.11	95	1.11	-96
3500	.87	126	1.21	-140	.13	86	1.10	-111
4000	.86	117	1.12	-164	.17	76	1.08	-125

V<sub>CB</sub> = 10 V, I<sub>C</sub> = 10 mA

100	.88	177	1.84	-6	.01	-31	1.01	-6
500	.88	171	1.84	-19	.01	112	1.00	-18
1000	.87	164	1.83	-38	.01	132	1.05	-36
1500	.90	159	1.82	-57	.03	118	1.08	-53
2000	.92	152	1.72	-76	.06	117	1.10	-69
2500	.95	144	1.68	-92	.08	108	1.09	-81
3000	.96	135	1.57	-113	.12	98	1.13	-96
3500	.96	125	1.45	-135	.15	88	1.12	-111
4000	.95	116	1.33	-156	.18	77	1.10	-126

V<sub>CB</sub> = 10 V, I<sub>C</sub> = 20 mA

100	.92	176	1.90	-6	.01	56	1.02	-6
500	.93	171	1.89	-19	.01	139	1.01	-18
1000	.92	164	1.89	-37	.01	129	1.05	-36
1500	.96	159	1.88	-55	.03	126	1.09	-53
2000	.97	152	1.81	-75	.06	119	1.10	-69
2500	1.01	142	1.75	-90	.09	110	1.09	-80
3000	1.02	132	1.67	-110	.12	100	1.13	-95
3500	1.03	121	1.55	-132	.15	89	1.13	-110
4000	1.02	112	1.42	-154	.18	79	1.12	-125

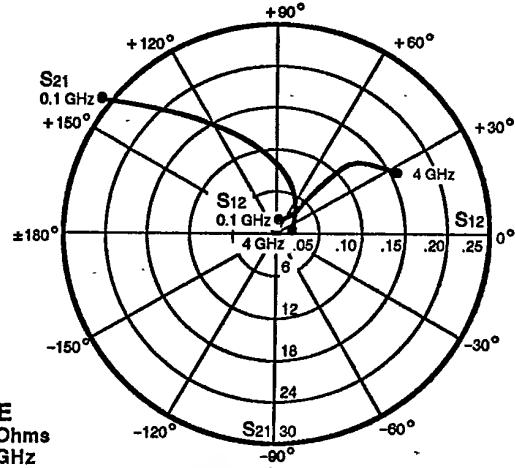
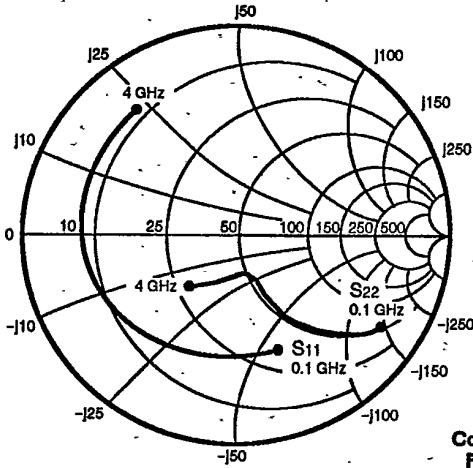
V<sub>CB</sub> = 10 V, I<sub>C</sub> = 40 mA

100	.95	176	1.93	-7	.01	-74	1.02	-7
500	.94	171	1.91	-20	.01	116	1.01	-19
1000	.94	163	1.91	-38	.01	133	1.05	-36
1500	.98	158	1.90	-57	.03	126	1.09	-53
2000	.99	151	1.83	-77	.06	119	1.10	-69
2500	1.04	141	1.81	-92	.09	111	1.09	-81
3000	1.05	132	1.72	-115	.12	100	1.13	-97
3500	1.05	120	1.58	-136	.15	88	1.13	-113
4000	1.03	111	1.46	-157	.18	77	1.10	-127





TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02107E  
Coordinates in Ohms  
Frequency in GHz  
(V<sub>CE</sub> = 10 V, I<sub>C</sub> = 20 mA)

S-MAGN AND ANGLES:

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 5 mA

FREQUENCY (MHz)

FREQUENCY (MHz)	S <sub>11</sub>	S <sub>21</sub>	S <sub>12</sub>	S <sub>22</sub>
100	.82 -36	13.90 157	.01 73	.95 -16
500	.70 -125	7.38 107	.07 35	.54 -47
1000	.68 -161	4.17 82	.08 25	.39 -59
1500	.68 -178	2.87 66	.09 24	.38 -68
2000	.68 170	2.18 53	.10 26	.37 -78
2500	.67 159	1.73 40	.11 22	.38 -90
3000	.67 151	1.49 28	.12 23	.40 -102
3500	.68 142	1.27 17	.13 19	.43 -112
4000	.68 134	1.16 6	.14 17	.45 -122

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 10 mA

100	.69 -54	22.57 150	.01 69	.89 -23
500	.67 -145	9.37 100	.05 36	.39 -58
1000	.67 -172	5.00 79	.06 36	.27 -70
1500	.67 175	3.40 65	.08 37	.26 -77
2000	.67 165	2.57 53	.09 40	.25 -87
2500	.67 154	2.07 41	.11 35	.28 -97
3000	.67 146	1.80 30	.12 34	.31 -108
3500	.67 137	1.53 20	.14 30	.34 -116
4000	.67 130	1.41 8	.15 23	.36 -125

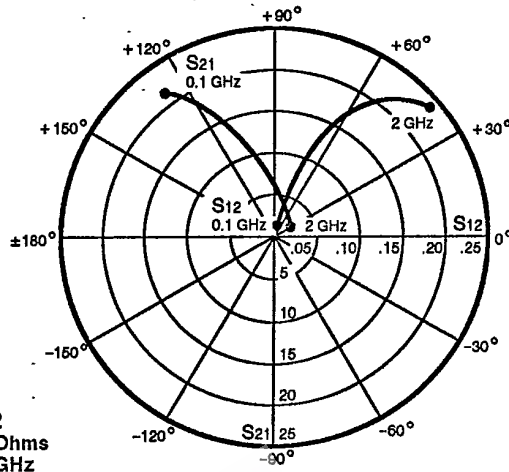
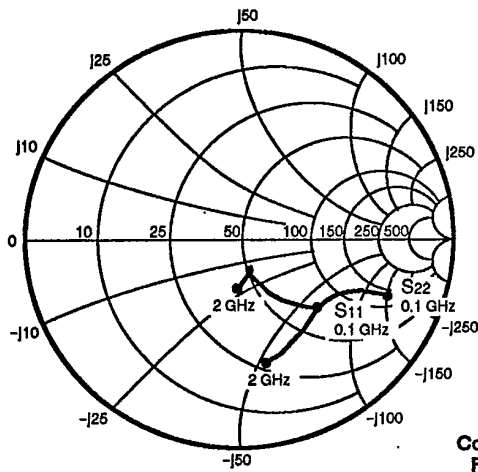
V<sub>CE</sub> = 10 V, I<sub>C</sub> = 20 mA

100	.58 -79	31.63 142	.01 65	.81 -32
500	.67 -161	10.57 95	.03 45	.28 -68
1000	.67 179	5.47 77	.04 46	.19 -78
1500	.67 168	3.70 64	.07 46	.19 -84
2000	.67 159	2.78 53	.09 48	.20 -96
2500	.67 150	2.26 42	.11 44	.23 -105
3000	.68 142	1.96 31	.12 39	.25 -114
3500	.67 134	1.68 21	.14 36	.28 -122
4000	.68 127	1.53 9	.16 27	.31 -128

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 30 mA

100	.55 -96	35.99 137	.01 63	.75 -37
500	.67 -167	10.79 93	.02 48	.24 -69
1000	.68 176	5.52 75	.04 53	.17 -77
1500	.68 166	3.75 63	.07 52	.17 -83
2000	.68 158	2.81 52	.09 53	.18 -96
2500	.68 148	2.26 41	.11 46	.21 -106
3000	.68 141	1.96 30	.13 42	.24 -115
3500	.68 133	1.66 20	.14 38	.27 -123
4000	.68 126	1.51 9	.16 29	.30 -131

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



**NE02112**  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 20 mA)

**S-MAGN AND ANGLES:**

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

	S11	S21	S12	S22
100	.76 -31	12.27 147	.01 69	.89 -16
200	.61 -52	9.59 126	.04 64	.78 -25
500	.33 -87	5.07 94	.09 61	.61 -36
1000	.17 -113	2.80 68	.15 60	.55 -47
1500	.14 -112	1.99 48	.20 53	.57 -63
2000	.18 -107	1.52 28	.22 40	.63 -82

VCE = 10 V, IC = 10 mA

100	.61 -37	17.41 136	.01 69	.81 -20
200	.45 -56	11.92 116	.03 69	.68 -26
500	.23 -82	5.64 88	.09 68	.54 -34
1000	.13 -94	3.03 66	.16 63	.51 -45
1500	.14 -90	2.13 47	.21 52	.53 -62
2000	.22 -96	1.62 27	.24 38	.60 -80

VCE = 10 V, IC = 20 mA

100	.47 -41	21.28 127	.01 76	.73 -21
200	.33 -56	13.15 108	.03 71	.62 -25
500	.18 -76	5.87 85	.09 70	.51 -32
1000	.11 -81	3.12 64	.16 64	.49 -43
1500	.14 -80	2.18 46	.22 53	.53 -61
2000	.23 -91	1.66 26	.24 38	.60 -80

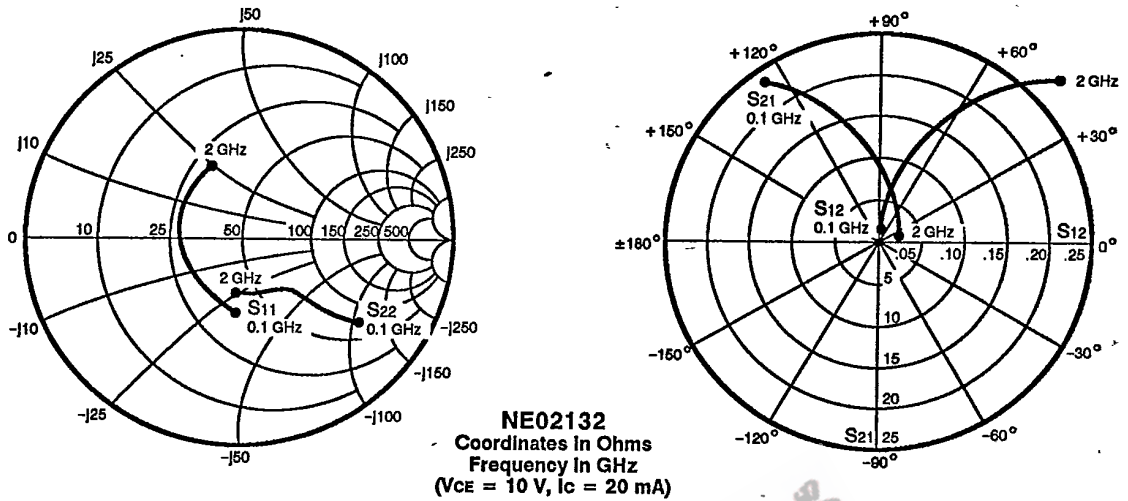
VCE = 10 V, IC = 40 mA

100	.37 -49	21.89 119	.01 71	.68 -19
200	.25 -64	12.81 103	.02 71	.60 -21
500	.13 -89	5.52 82	.09 71	.53 -28
1000	.07 -99	2.93 62	.16 65	.52 -41
1500	.10 -87	2.06 44	.21 53	.55 -59
2000	.18 -94	1.56 24	.23 39	.62 -79



T-31-17

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



S-MAGN AND ANGLES:

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 5 mA

FREQUENCY (MHz)

	S <sub>11</sub>	S <sub>21</sub>	S <sub>12</sub>	S <sub>22</sub>
100	.70 -45	12.65 145	.03 71	.88 -21
200	.54 -80	9.63 123	.05 55	.70 -34
500	.39 -136	5.06 92	.09 53	.46 -47
1000	.35 176	2.77 63	.14 52	.40 -57
1500	.36 145	1.97 44	.20 51	.37 -72
2000	.41 120	1.62 25	.26 43	.36 -88

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 10 mA

100	.50 -64	18.88 135	.02 69	.78 -29
200	.37 -105	12.46 113	.03 57	.56 -40
500	.31 -155	5.84 86	.09 64	.35 -48
1000	.30 163	3.12 62	.15 58	.32 -57
1500	.32 136	2.20 44	.22 53	.30 -73
2000	.37 114	1.80 26	.28 42	.29 -89

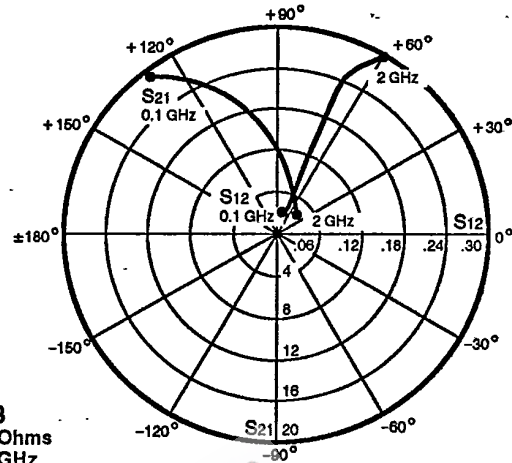
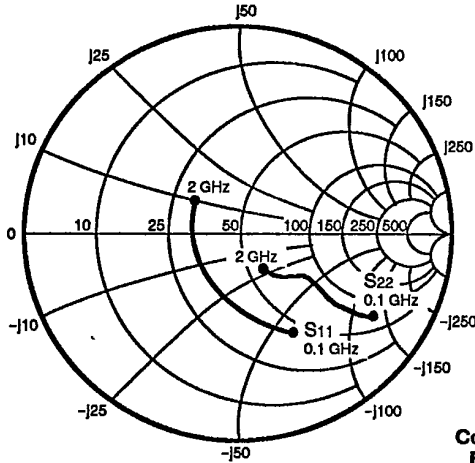
V<sub>CE</sub> = 10 V, I<sub>C</sub> = 20 mA

100	.34 -90	23.82 125	.01 71	.67 -34
200	.27 -133	14.23 105	.03 66	.45 -42
500	.27 -171	6.24 83	.09 70	.29 -46
1000	.29 155	3.31 60	.16 62	.28 -55
1500	.30 131	2.32 43	.23 54	.26 -74
2000	.35 111	1.88 26	.29 42	.26 -90

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 40 mA

100	.27 -118	26.55 117	.01 73	.57 -36
200	.26 -156	14.82 100	.02 75	.38 -39
500	.27 179	6.32 81	.09 74	.27 -41
1000	.29 151	3.33 59	.16 63	.27 -53
1500	.31 128	2.34 43	.23 55	.26 -71
2000	.36 109	1.89 25	.29 42	.25 -88

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02133  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

	S11		S21		S12		S22	
100	.80	-37	13.53	150	.03	73	.91	-18
200	.63	-63	10.48	129	.04	59	.72	-29
500	.37	-114	5.56	99	.09	61	.48	-38
1000	.27	-158	3.02	76	.15	60	.40	-41
1500	.27	172	2.16	63	.21	63	.34	-49
2000	.29	151	1.74	49	.27	58	.31	-62

VCE = 10 V, IC = 10 mA

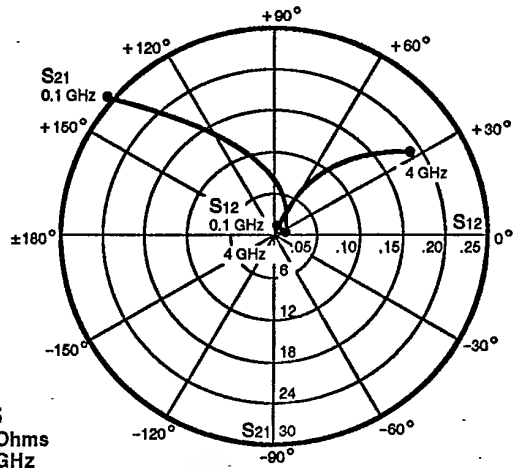
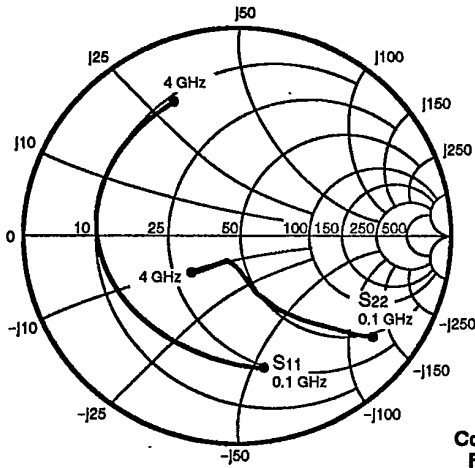
100	.66	-48	19.53	139	.02	79	.81	-27
200	.46	-78	13.52	118	.03	58	.58	-35
500	.27	-129	6.29	93	.09	67	.38	-36
1000	.21	-169	3.31	74	.16	66	.34	-40
1500	.23	165	2.35	62	.23	64	.29	-47
2000	.26	146	1.87	50	.29	59	.26	-62

VCE = 10 V, IC = 20 mA

100	.51	-61	19.37	129	.02	79	.70	-32
200	.33	-91	15.04	109	.03	64	.48	-35
500	.21	-143	6.57	89	.08	71	.33	-32
1000	.19	-177	3.41	72	.16	69	.32	-37
1500	.21	160	2.41	61	.24	67	.26	-45
2000	.24	142	1.92	49	.30	59	.23	-59



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02135  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

	S11	S21	S12	S22
100	.84 -36	13.82 156	.02 73	.94 -18
500	.68 -126	7.18 106	.08 35	.51 -53
1000	.66 -163	4.02 81	.09 27	.34 -66
1500	.65 178	2.75 64	.10 27	.31 -74
2000	.65 163	2.10 52	.12 30	.31 -83
2500	.66 151	1.68 39	.13 26	.31 -95
3000	.66 141	1.46 27	.14 26	.33 -106
3500	.67 129	1.24 17	.16 26	.36 -116
4000	.68 121	1.14 5	.17 23	.38 -127

VCE = 10 V, IC = 10 mA

100	.73 -55	22.55 148	.02 65	.87 -27
500	.64 -148	8.90 98	.06 37	.36 -66
1000	.64 -176	4.71 77	.07 39	.23 -82
1500	.64 169	3.19 63	.09 40	.21 -87
2000	.65 156	2.42 52	.11 42	.21 -97
2500	.65 145	1.95 40	.13 37	.22 -108
3000	.66 135	1.69 29	.15 35	.25 -118
3500	.66 125	1.43 19	.17 32	.27 -127
4000	.68 117	1.34 8	.19 28	.29 -137

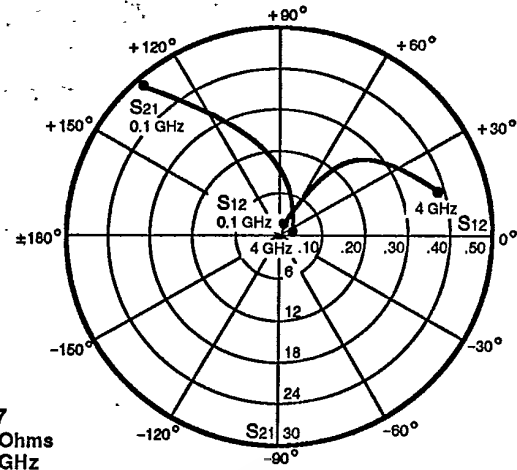
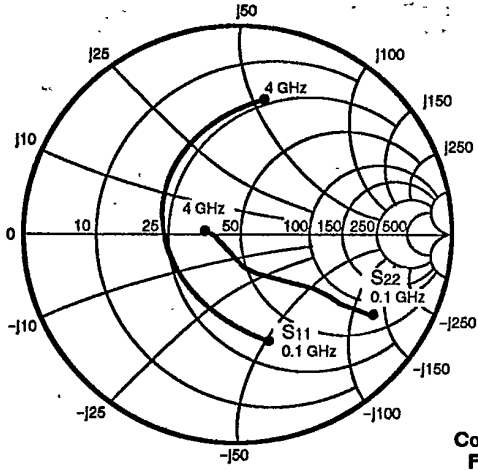
VCE = 10 V, IC = 20 mA

100	.62 -80	31.13 139	.01 60	.77 -37
500	.64 -163	9.88 93	.04 46	.26 -79
1000	.65 176	5.07 75	.06 49	.16 -95
1500	.64 164	3.45 63	.08 50	.15 -101
2000	.65 154	2.60 52	.11 51	.16 -111
2500	.66 142	2.10 40	.13 43	.18 -121
3000	.66 133	1.81 30	.15 40	.20 -129
3500	.66 122	1.55 20	.17 36	.22 -136
4000	.68 115	1.43 8	.19 31	.25 -144

VCE = 10 V, IC = 30 mA

100	.58 -95	35.35 134	.01 59	.72 -40
500	.64 -169	10.11 91	.03 50	.22 -82
1000	.65 173	5.15 74	.06 55	.14 -97
1500	.65 162	3.49 62	.08 53	.14 -103
2000	.66 152	2.63 52	.11 54	.15 -112
2500	.66 141	2.10 39	.13 46	.17 -122
3000	.66 132	1.82 29	.15 42	.19 -129
3500	.67 122	1.54 20	.17 38	.22 -137
4000	.68 115	1.44 9	.20 31	.24 -146

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02137  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

	S11		S21		S12		S22	
100	.81	-36	13.62	152	.02	72	.92	-17
500	.46	-127	6.36	98	.08	48	.50	-39
1000	.42	-176	3.51	72	.11	48	.38	-46
1500	.43	154	2.43	53	.15	46	.35	-54
2000	.46	133	1.87	39	.19	44	.33	-65
2500	.53	113	1.54	23	.23	37	.24	-86
3000	.58	100	1.33	9	.27	31	.23	-112
3500	.61	88	1.15	-1	.31	23	.21	-144
4000	.65	79	1.04	-16	.35	16	.26	-155

VCE = 10 V, IC = 10 mA

100	.66	-52	21.54	142	.02	72	.83	-24
500	.37	-149	7.49	91	.07	56	.38	-39
1000	.37	170	3.96	69	.11	57	.29	-45
1500	.39	146	2.71	53	.16	52	.27	-53
2000	.43	128	2.08	39	.21	47	.24	-67
2500	.51	109	1.70	24	.25	38	.17	-91
3000	.56	97	1.46	10	.29	30	.15	-123
3500	.60	86	1.25	-0	.32	22	.15	-159
4000	.63	77	1.15	-14	.36	14	.19	-171

VCE = 10 V, IC = 20 mA

100	.51	-73	28.85	131	.01	69	.72	-30
500	.34	-167	8.09	87	.06	64	.31	-36
1000	.36	161	4.18	67	.11	63	.24	-42
1500	.38	140	2.85	52	.17	54	.22	-52
2000	.41	124	2.19	38	.22	50	.20	-66
2500	.50	107	1.78	24	.26	39	.12	-94
3000	.55	96	1.52	11	.30	30	.12	-133
3500	.58	84	1.31	0	.32	22	.12	-177
4000	.62	77	1.20	-13	.37	14	.17	-179

VCE = 10 V, IC = 30 mA

100	.45	-88	31.67	125	.01	70	.66	-32
500	.33	-174	8.10	85	.06	67	.29	-33
1000	.36	158	4.16	66	.11	64	.24	-40
1500	.39	139	2.84	51	.16	56	.22	-50
2000	.42	123	2.18	38	.22	50	.20	-63
2500	.50	106	1.77	23	.26	39	.12	-91
3000	.55	95	1.51	9	.30	30	.11	-130
3500	.58	85	1.29	0	.32	24	.07	-163
4000	.62	76	1.20	-12	.36	14	.16	-180

