

NEC[®]**NPN SILICON HIGH
FREQUENCY TRANSISTOR****NE021
SERIES****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

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CE0}	Collector to Base Voltage	V	25
V_{CE0}	Collector to Emitter Voltage	V	12 ¹
V_{EB0}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	70
T_J	Junction Temperature	$^\circ\text{C}$	200 ²
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +200 ³

Notes:

1. Typical $BV_{CE0} = 25\text{ V}$ for $R \leq 300\ \Omega$.
2. Maximum T_J for the NE02132, NE02133, NE02136, and NE02137 is $+150^\circ\text{C}$.
3. Maximum storage temperature for the NE02132, NE02135, NE02136 and NE02137 is -65 to $+150^\circ\text{C}$. Maximum storage temperature for the NE02133 is -55 to $+150^\circ\text{C}$.

NE02135 TYPICAL NOISE PARAMETERS $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$

FREQUENCY (MHz)	NFmin (dB)	GA	OPT SOURCE	$R_n/50\ \Omega$
500	1.2	18.6	.36 $\angle 69^\circ$	.14
1000	1.5	13.9	.31 $\angle 124^\circ$	.12
1500	2.0	12.1	.50 $\angle 165^\circ$	.05
2000	2.4	9.6	.44 $\angle -175^\circ$	.06
2500	2.6	8.9	.62 $\angle -161^\circ$	.10
3000	3.6	8.6	.68 $\angle -141^\circ$	.14
3500	3.7	6.9	.71 $\angle -139^\circ$	.21

 $V_{CE} = 10\text{ V}, I_C = 20\text{ mA}$

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

PERFORMANCE SPECIFICATIONS ($T_A = 25^\circ\text{C}$)

EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE		NE02100 00 (CHIP)		NE02103 2SC1560(C) 03		NE02107 07		NE02112 2SC1988 12		NE02132 2SC2570 32		NE02133 2SC2351 33		NE02135 2SC2149 35		NE02137 2SC2369 37	
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f_r	Gain Bandwidth Product at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$	GHz		4.5			4.5			4.5			4.5			4.5	
$ S_{21} ^2$	Insertion Power Gain at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$, $f = 0.5\text{ GHz}$ $f = 1\text{ GHz}$ $f = 2\text{ GHz}$	dB dB dB		18.5 13 6.5			18.5 13 6.5			15 10 4			18.5 13 5.7			9 11	
NF _{MIN}	Minimum Noise Figure ² at $V_{CE} = 10\text{ V}$, $I_C = 3\text{ mA}$, $f = 0.5\text{ GHz}$ $V_{CE} = 10\text{ V}$, $I_C = 5\text{ mA}$, $f = 1\text{ GHz}$ $f = 2\text{ GHz}$	dB dB dB		1.5 2.7 4.5			1.5 2.7 4.5			1.5 3			1.5 3			1.8 3	
MAG	Maximum Available Gain ³ at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$, $f = 0.5\text{ GHz}$ $f = 1\text{ GHz}$ $f = 2\text{ GHz}$	dB dB dB		22 18 12			22 18 12			11.5			22 18 11			14	

Notes:

- Electronic Industrial Association of Japan.
- Input and output are tuned for optimum noise figures.
- 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 ($T_A = 25^\circ\text{C}$)

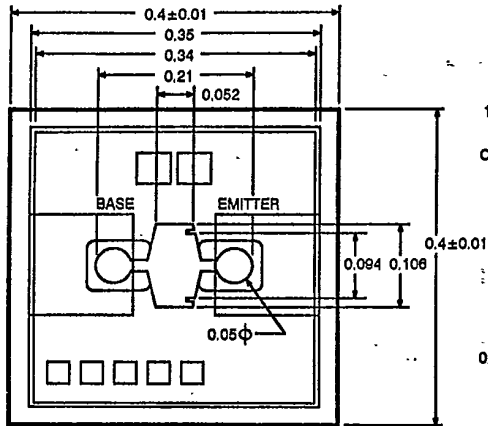
EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE		NE02100 00 (CHIP)		NE02103 2SC1560(C) 03		NE02107 07		NE02112 2SC1988 12		NE02132 2SC2570 32		NE02133 2SC2351 33		NE02135 2SC2149 35		NE02137 2SC2369 37	
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I_{CBO}	Collector Cutoff Current at $V_{CB} = 15\text{ V}$, $I_E = 0$	μA			1.0			1.0			1.0			1.0			1.0
I_{EBO}	Emitter Cutoff Current at $V_{EB} = 2\text{ V}$, $I_C = 0$	μA			1.0			1.0			1.0			1.0			1.0
h_{FE}	Forward Current Gain at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$		20	70	250	20	70	250	20	70	250	20	70	250	20	70	250
C_{CB}	Collector to Base Capacitance ² at $V_{CB} = 10\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$	pF		0.6	1.0		0.6	1.0		0.7	0.9		0.75	1.0		0.75	1.0
R_{TH}	Thermal Resistance ($\mu\text{-C}$)	$^\circ\text{C/W}$		70			90							120			
R_{TH}	Thermal Resistance ($\mu\text{-A}$)				300		500						666				500
P_T^3	Total Power Dissipation	mW	580	700	700	350	700	700	350	250	250	150	290	500	250	250	250

Notes:

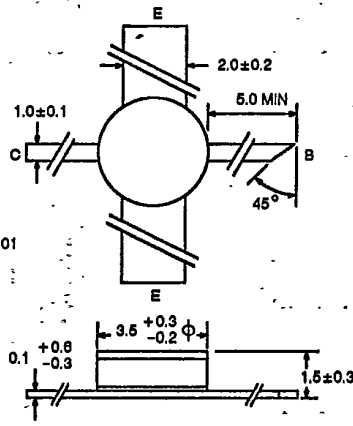
- Electronic Industrial Association of Japan.
- C_{CB} measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.
- Minimum dissipation based on $R_{TH}(\mu\text{-A})$ for applications without effective heatsink, maximum dissipation based on $R_{TH}(\mu\text{-C})$ for applications with effective heatsink.

OUTLINE DIMENSIONS (Units in mm)

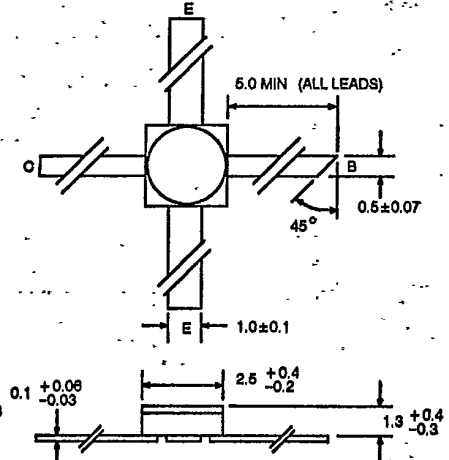
NE02100 (CHIP)
(Chip Thickness: 140 μ m)



OUTLINE 03

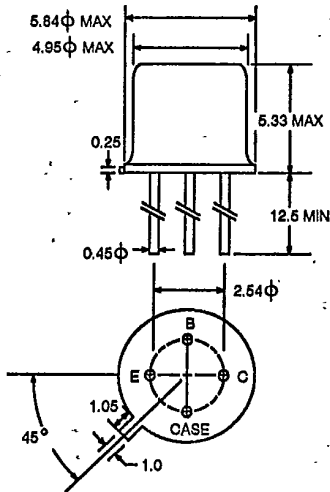


OUTLINE 07

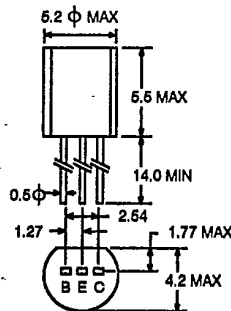


*07B has emitter and base reversed.

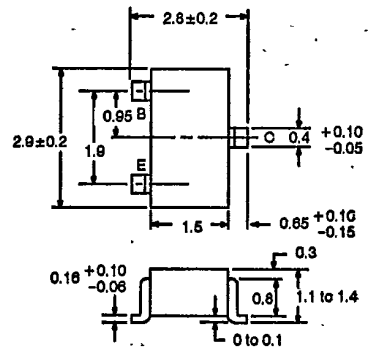
OUTLINE 12
(TO-72)



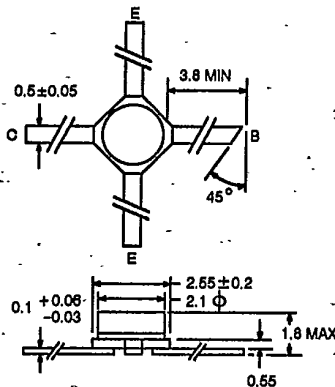
OUTLINE 32
(TO-92)



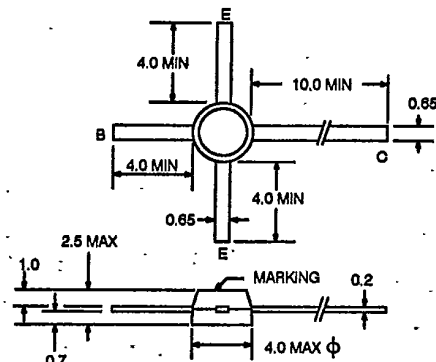
OUTLINE 33
(SOT-23)



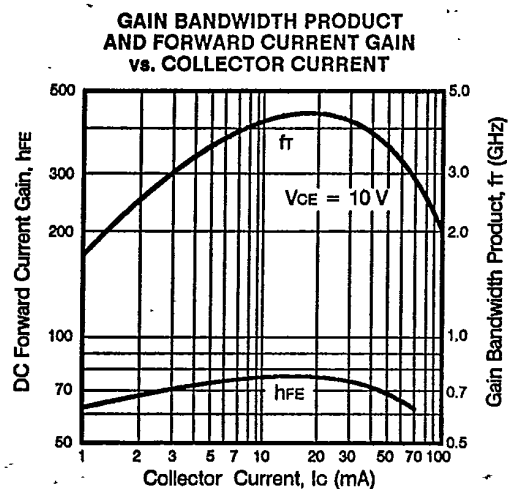
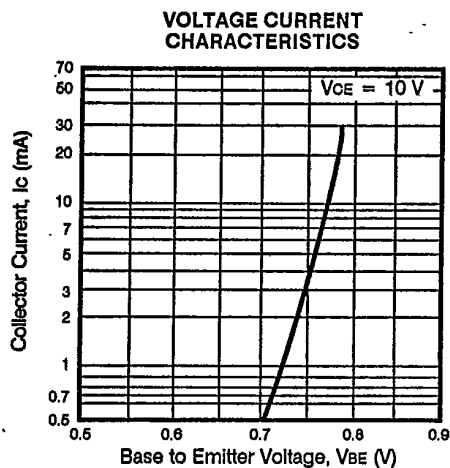
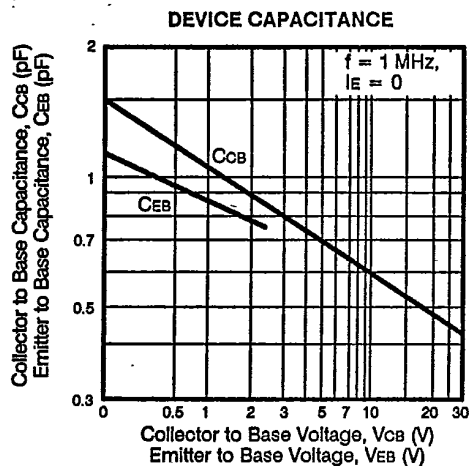
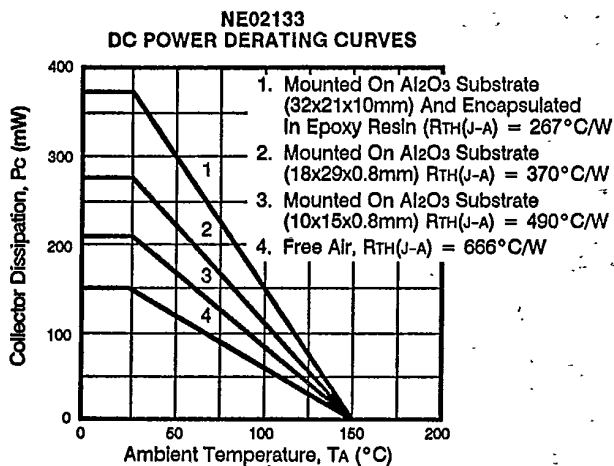
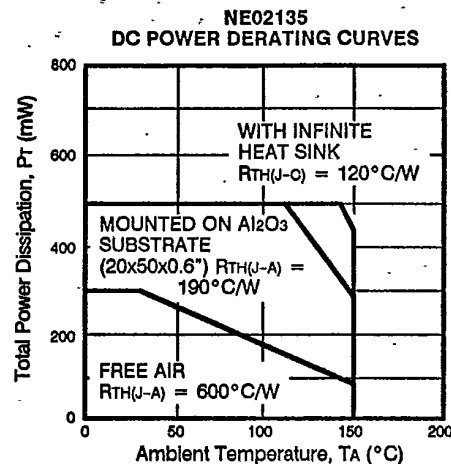
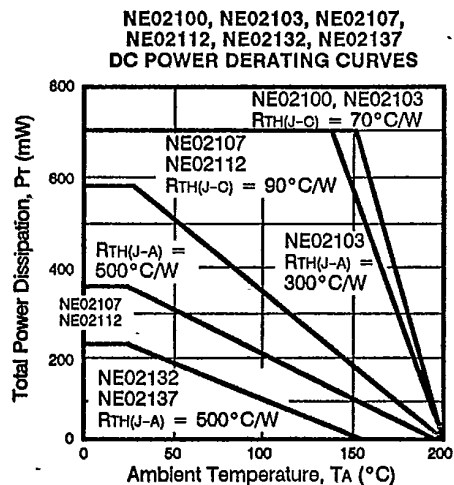
OUTLINE 35
(MICRO-X)



OUTLINE 37

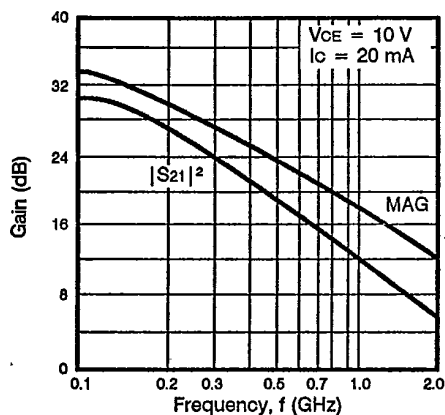


*The NE02136 is available with only the bottom emitter lead.

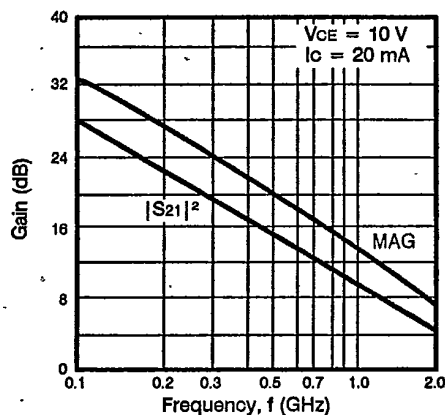
TYPICAL DEVICE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)T-31-17
T-31-19

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

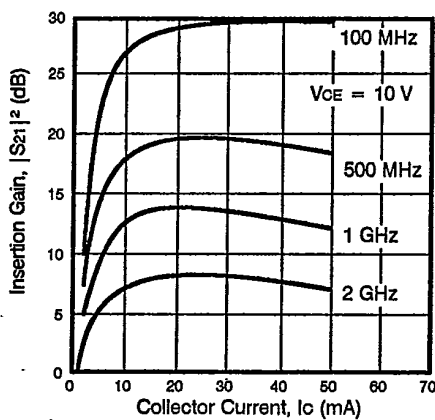
NE02103, NE02107, NE02135
GAIN vs. FREQUENCY



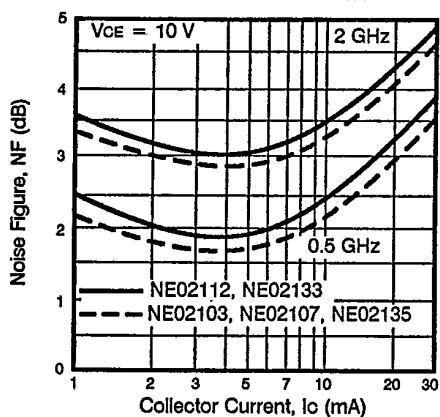
NE02112, NE02133
GAIN vs. FREQUENCY



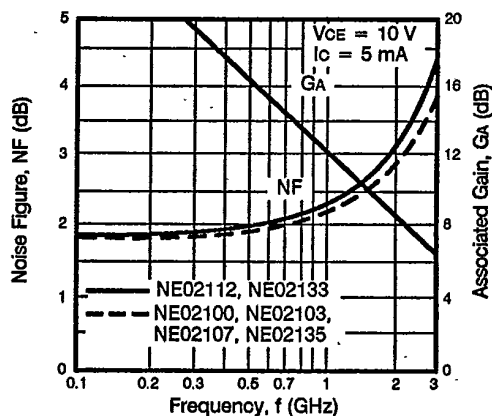
NE02103, NE02107
INSERTION GAIN vs. COLLECTOR CURRENT



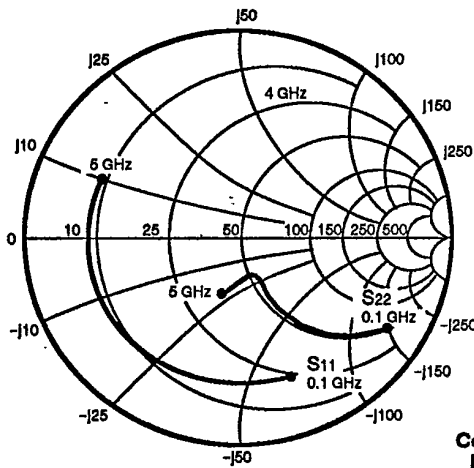
NOISE FIGURE vs.
COLLECTOR CURRENT



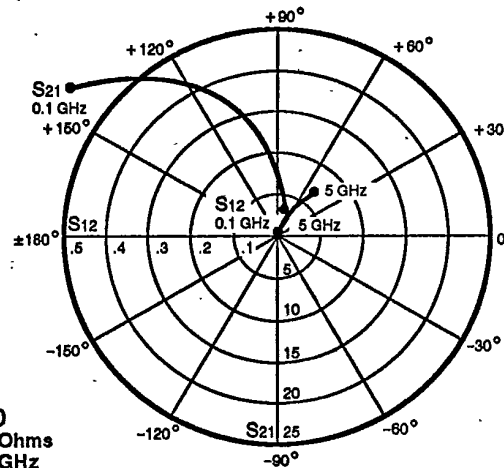
NOISE FIGURE AND ASSOCIATED
GAIN vs. FREQUENCY



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)	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 -61	.54	16.9
1500	.71 -164	2.85 76	.09 27	.35 -66	.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

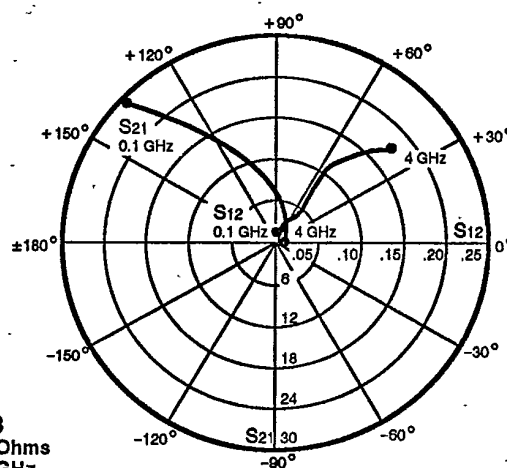
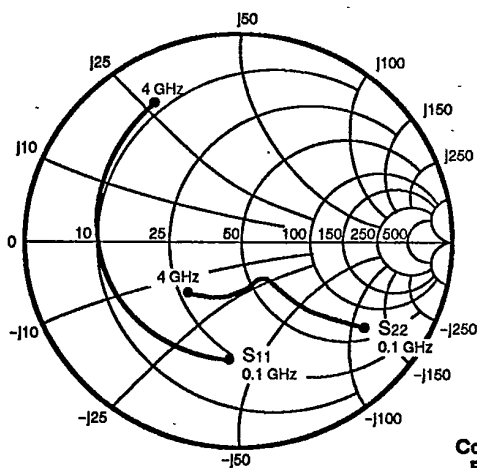
FREQUENCY (MHz)	S11	S21	S12	S22	k	GMA dB
100	.75 -47	20.04 153	.02 65	.89 -24	.11	29.2
500	.72 -137	9.40 105	.05 34	.41 -57	.39	22.5
1000	.72 -162	4.97 86	.06 34	.27 -62	.69	19.0
1500	.71 -173	3.37 75	.07 38	.23 -66	.92	16.8
2000	.71 -179	2.56 66	.08 41	.22 -71	1.09	13.2
2500	.71 176	2.05 58	.09 43	.23 -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

FREQUENCY (MHz)	S11	S21	S12	S22	k	GMA dB
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

	S11	S21	S12	S22
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

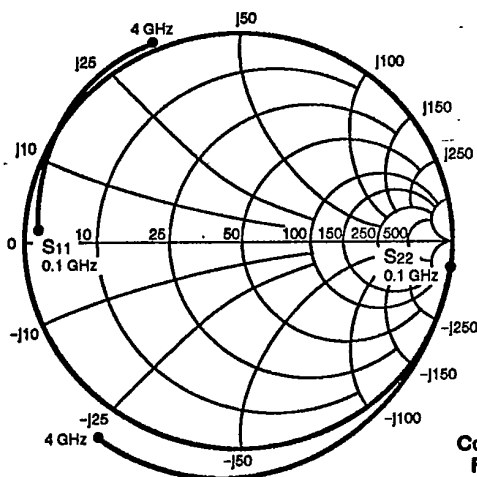
VCE = 10 V, IC = 20 mA

	S11	S21	S12	S22
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

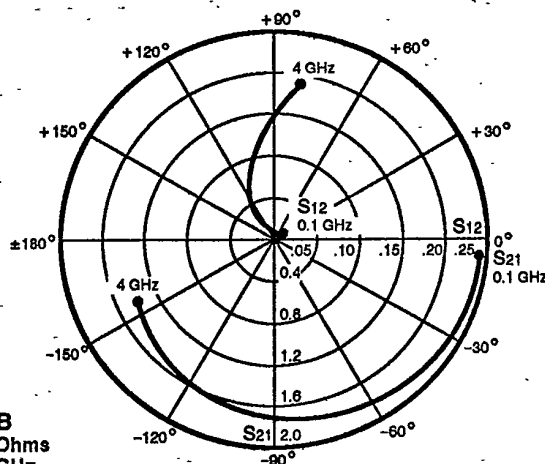
VCE = 10 V, IC = 40 mA

	S11	S21	S12	S22
100	.53 -121	34.50 128	.01 66	.66 -38
500	.66 -175	9.00 88	.03 61	.23 -50
1000	.67 171	4.56 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_{CB} = 10 V, I_C = 20 mA)



S-MAGN AND ANGLES:

V_{CB} = 10 V, I_C = 5 mA

FREQUENCY (MHz)

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

V_{CB} = 10 V, I_C = 10 mA

.88	177	1.84	-6	.01	-31	1.01	-6
.88	171	1.84	-19	.01	112	1.00	-18
.87	164	1.83	-38	.01	132	1.05	-36
.90	169	1.82	-57	.03	118	1.08	-53
.92	152	1.72	-76	.06	117	1.10	-69
.95	144	1.68	-92	.08	108	1.09	-81
.96	135	1.57	-113	.12	98	1.13	-96
.96	125	1.45	-135	.15	88	1.12	-111
.95	116	1.33	-156	.18	77	1.10	-126

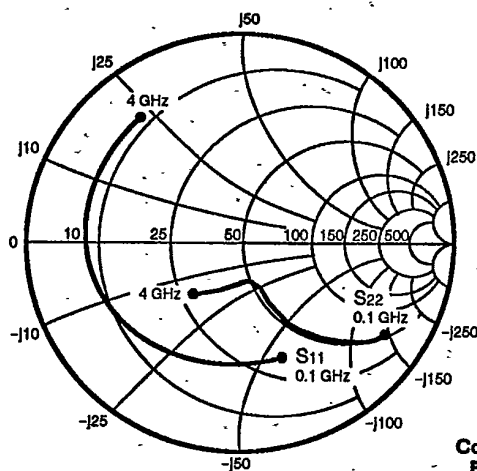
V_{CB} = 10 V, I_C = 20 mA

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

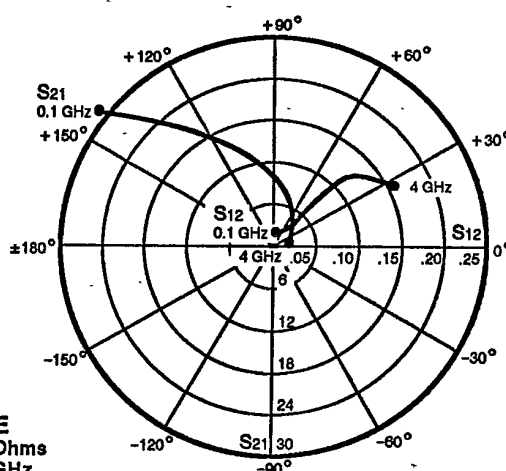
V_{CB} = 10 V, I_C = 40 mA

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
(VCE = 10 V, IC = 20 mA)



S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

FREQUENCY (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
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

VCE = 10 V, IC = 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

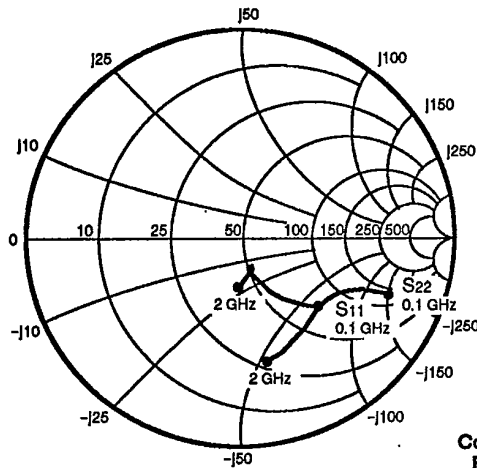
VCE = 10 V, IC = 20 mA

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

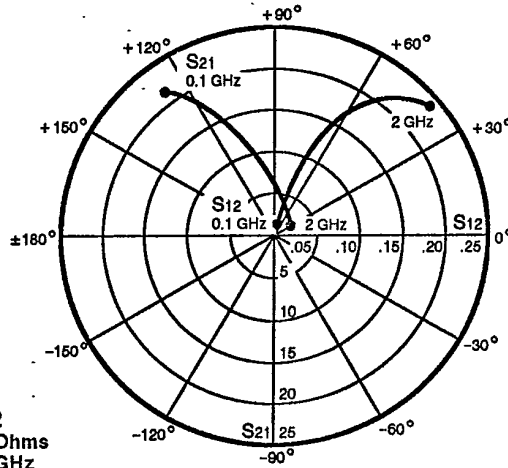
VCE = 10 V, IC = 30 mA

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
(V_{CE} = 10 V, I_C = 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

	S11	S21	S12	S22
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

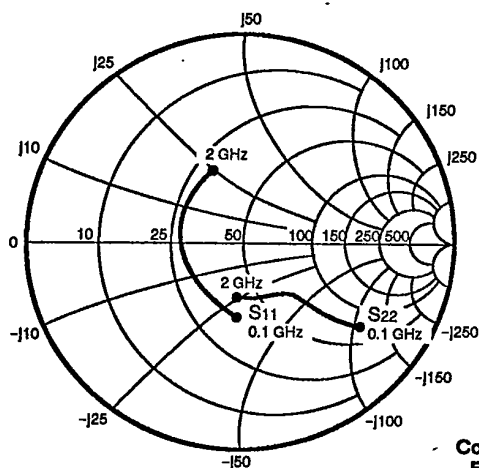
	S11	S21	S12	S22
100	.47 -41	21.28 127	.01 76	.73 -21
200	.33 -56	13.15 108	.03 71	.62 -25
500	.18 -76	5.87 85	.09 70	.51 -32
1000	.11 -81	3.12 64	.16 64	.49 -43
1500	.14 -80	2.18 46	.22 53	.53 -61
2000	.23 -91	1.66 26	.24 38	.60 -80

VCE = 10 V, IC = 40 mA

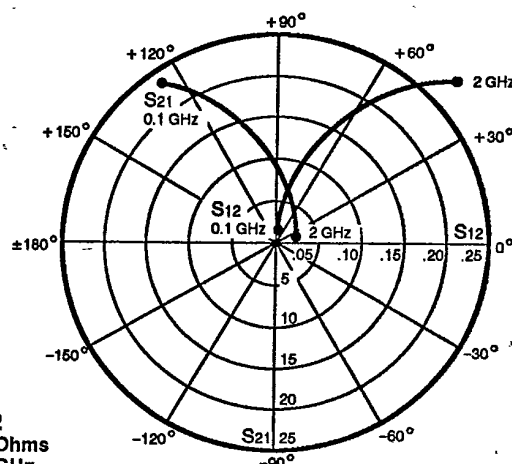
	S11	S21	S12	S22
100	.37 -49	21.89 119	.01 71	.68 -19
200	.25 -64	12.81 103	.02 71	.60 -21
500	.13 -89	5.52 82	.09 71	.53 -28
1000	.07 -99	2.93 62	.16 65	.52 -41
1500	.10 -87	2.06 44	.21 53	.55 -59
2000	.18 -94	1.56 24	.23 39	.62 -79

T-31-17

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02132
Coordinates in Ohms
Frequency in GHz
($V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$)

**S-MAGN AND ANGLES:** $V_{CE} = 10\text{ V}$, $I_C = 5\text{ mA}$

FREQUENCY (MHz)

	S_{11}	S_{21}	S_{12}	S_{22}
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

 $V_{CE} = 10\text{ V}$, $I_C = 10\text{ mA}$

	S_{11}	S_{21}	S_{12}	S_{22}
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

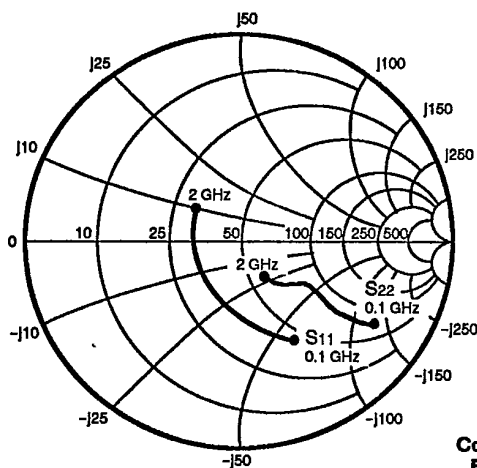
 $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$

	S_{11}	S_{21}	S_{12}	S_{22}
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

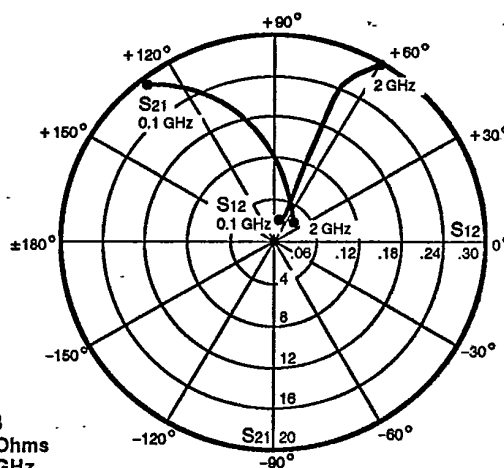
 $V_{CE} = 10\text{ V}$, $I_C = 40\text{ mA}$

	S_{11}	S_{21}	S_{12}	S_{22}
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

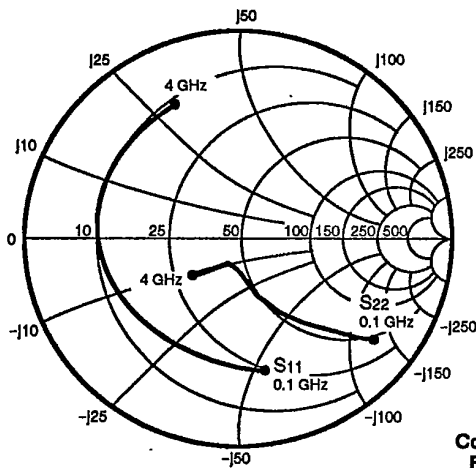
	S11	S21	S12	S22
100	.66 -48	19.53 139	.02 79	.81 -27
200	.46 -78	13.52 118	.03 58	.58 -35
500	.27 -129	6.29 93	.09 67	.38 -36
1000	.21 -169	3.31 74	.16 66	.34 -40
1500	.23 165	2.35 62	.23 64	.29 -47
2000	.26 146	1.87 50	.29 59	.26 -62

VCE = 10 V, IC = 20 mA

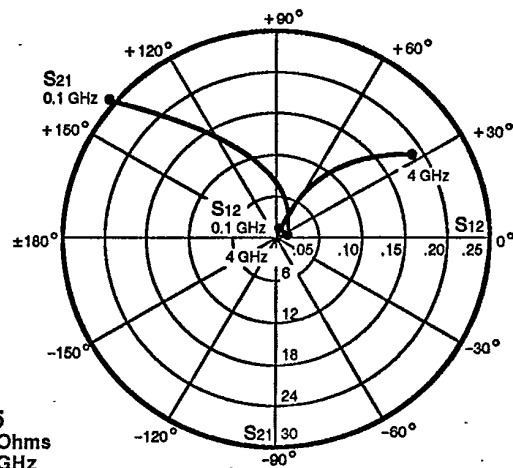
	S11	S21	S12	S22
100	.51 -61	19.37 129	.02 79	.70 -32
200	.33 -91	15.04 109	.03 64	.48 -35
500	.21 -143	6.57 89	.08 71	.33 -32
1000	.19 -177	3.41 72	.16 69	.32 -37
1500	.21 160	2.41 61	.24 67	.26 -45
2000	.24 142	1.92 49	.30 59	.23 -59

2

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)

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

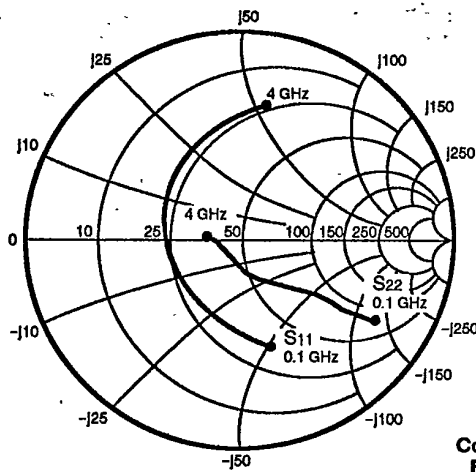
VCE = 10 V, IC = 20 mA

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

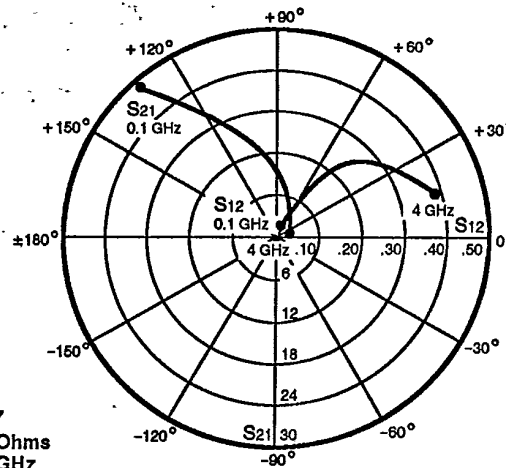
VCE = 10 V, IC = 30 mA

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

	S11	S21	S12	S22
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

	S11	S21	S12	S22
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

	S11	S21	S12	S22
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