

NEC®**NPN SILICON HIGH
FREQUENCY TRANSISTOR****NE68000
NE68033
NE68035
NE68037****FEATURES**

- **HIGH GAIN BANDWIDTH PRODUCT:** $f_T = 10 \text{ GHz}$
- **LOW NOISE FIGURE:**
1.7 dB TYP at 2 GHz
2.6 dB TYP at 4 GHz
- **HIGH ASSOCIATED GAIN:**
12.5 dB TYP at 2 GHz
8.0 dB TYP at 4 GHz

DESCRIPTION AND APPLICATIONS

The NE680 series of NPN epitaxial silicon transistors is designed for low noise, high gain and low cost amplifier applications. The device is available in chip form as well as in package types 33, 35 and 37. Both the chip form and package type 35 are suitable for amplifiers from 0.5 to 6 GHz. The devices in the 33 and 37 packages are suitable for VHF and UHF low noise amplifiers.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CB0}	Collector to Base Voltage	V	20
V_{CE0}	Collector to Emitter Voltage	V	10
V_{EB0}	Emitter to Base Voltage	V	1.5
I_C	Collector Current	mA	35
T_J	Junction Temperature	$^\circ\text{C}$	200*
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +150

*Maximum T_J for the NE68033 and NE68037 is 150°C .

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

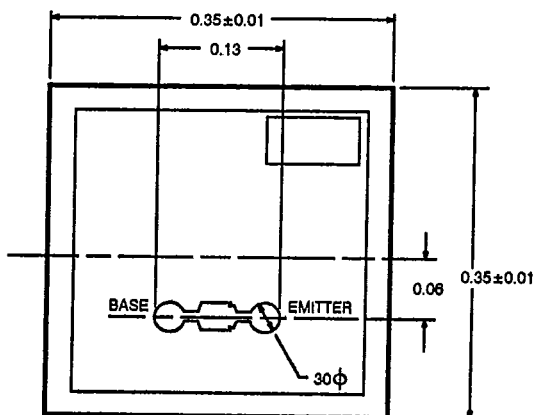
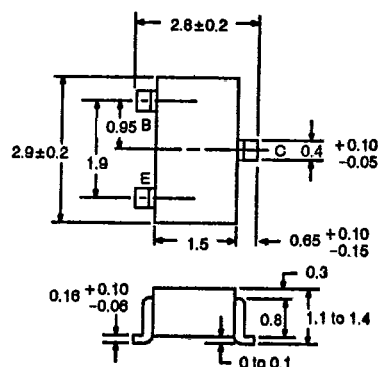
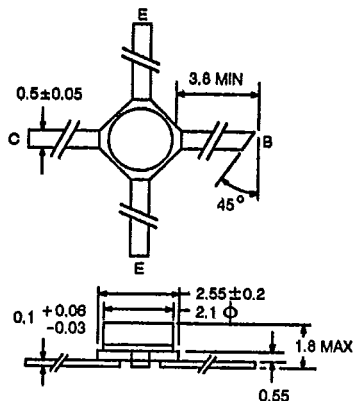
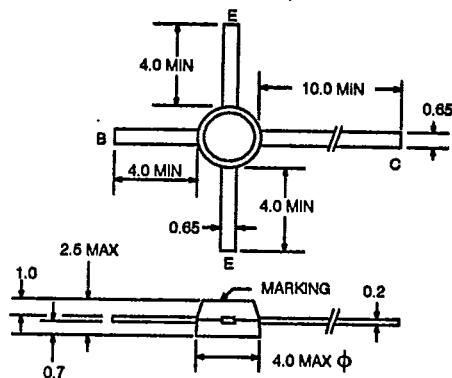
PART NUMBER EIAJ* REGISTERED NUMBER PACKAGE OUTLINE			NE68033 2SC3585 33			NE68035 2SC3587 35			NE68037 2SC3586 37		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f_T	Gain Bandwidth Product at $V_{CE} = 6 \text{ V}$, $I_C = 10 \text{ mA}$	GHz		10			10			10	
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 6 \text{ V}$, $I_C = 10 \text{ mA}$, $f = 2 \text{ GHz}$ $f = 4 \text{ GHz}$	dB dB	6	8		10.5	12.5 7.5		7.5	9.5	
MAG	Maximum Available Gain at $V_{CE} = 6 \text{ V}$, $I_C = 10 \text{ mA}$, $f = 2 \text{ GHz}$ $f = 4 \text{ GHz}$	dB dB		10			10			12	
NF	Noise Figure at $V_{CE} = 6 \text{ V}$, $I_C = 5 \text{ mA}$, $f = 2 \text{ GHz}$ $f = 4 \text{ GHz}$	dB dB		1.8	3		1.7 2.6	2.4		1.8	3
GNF	Associated Gain at Noise Figure at $V_{CE} = 6 \text{ V}$, $I_C = 5 \text{ mA}$, $f = 2 \text{ GHz}$ $f = 4 \text{ GHz}$	dB dB		9			12.5 8			11	

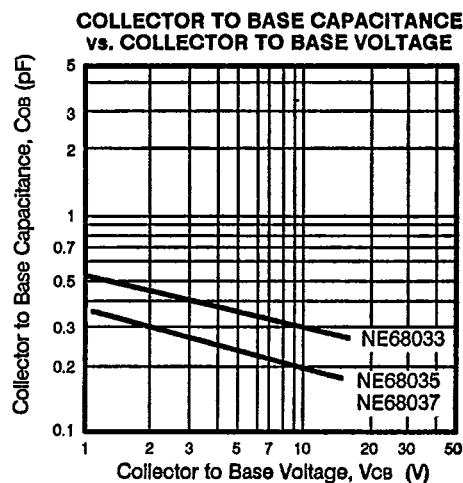
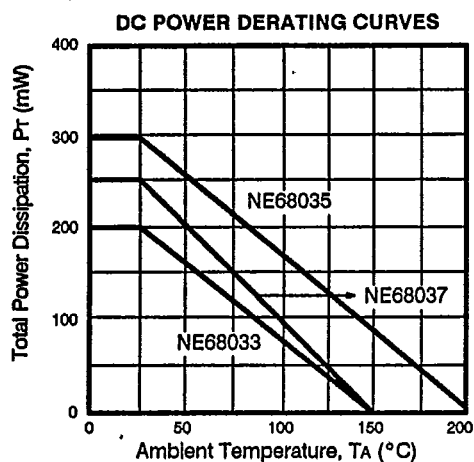
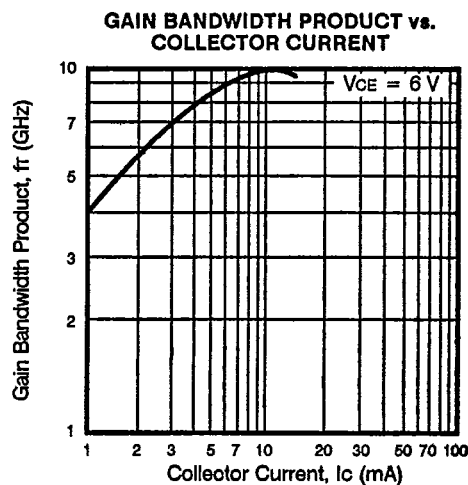
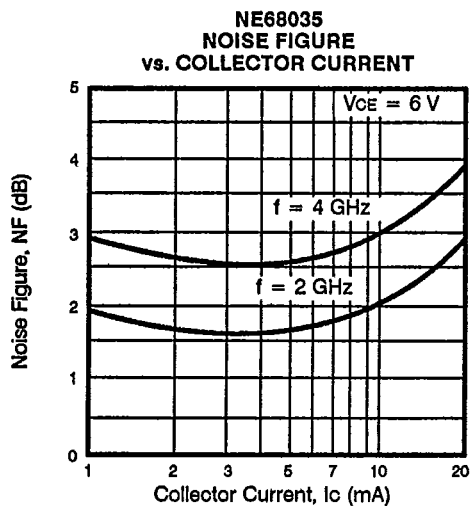
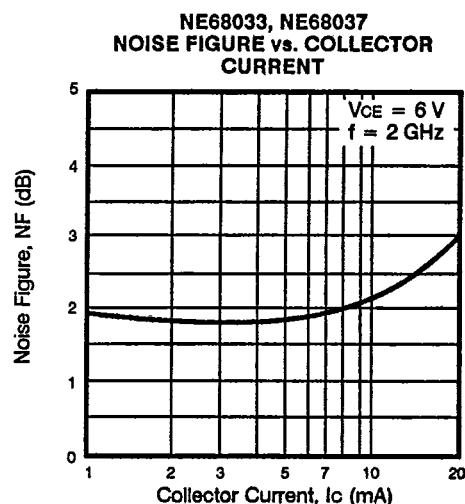
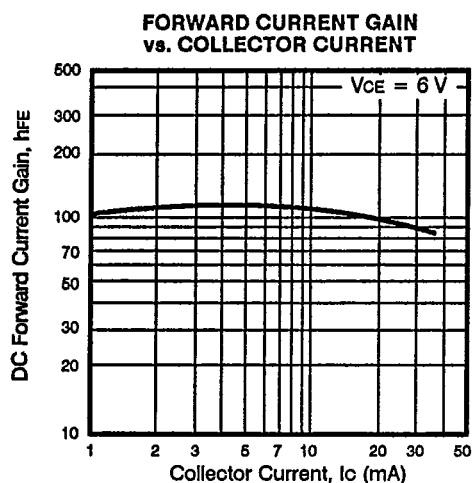
*Electronic Industrial Association of Japan.

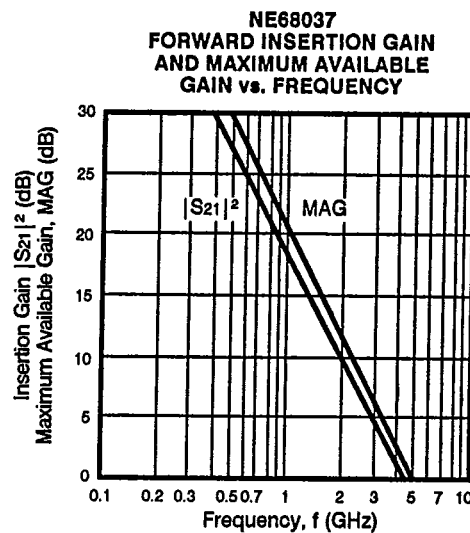
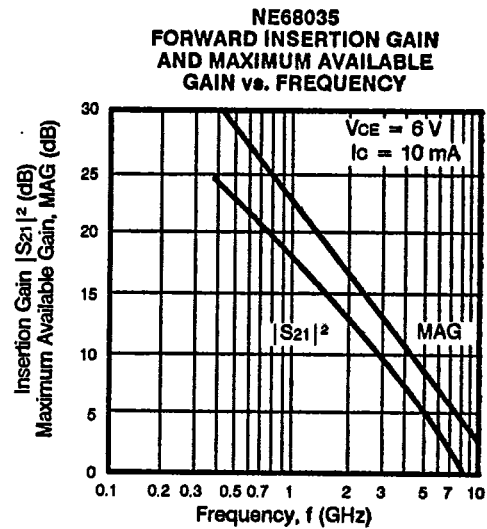
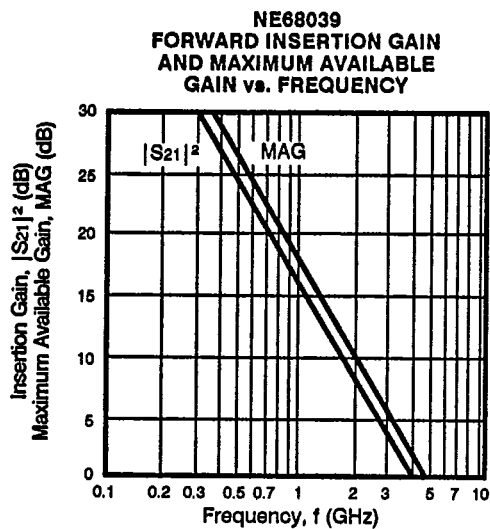
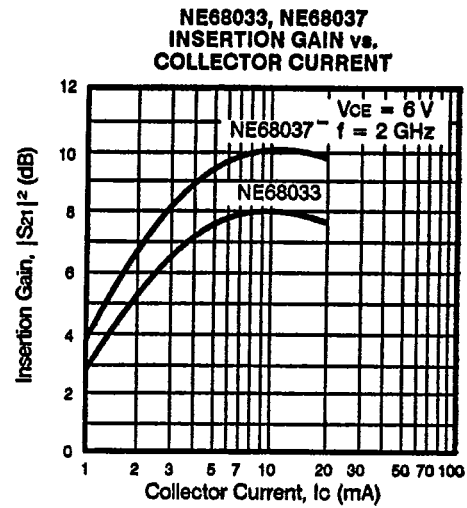
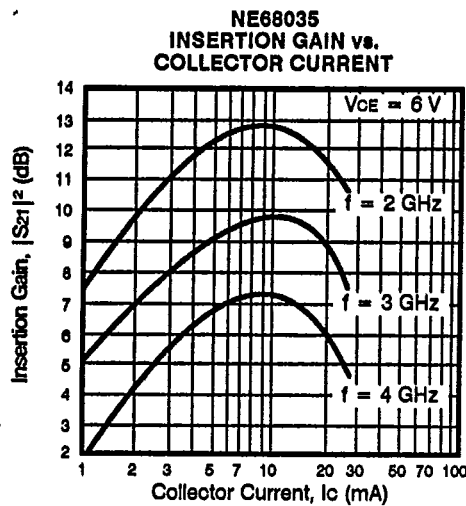
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

PART NUMBER EIAJ* REGISTERED NUMBER PACKAGE OUTLINE			NE68033 2SC3585 33			NE68035 2SC3587 35			NE68037 2SC3586 37		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I_{CBO}	Collector Cutoff Current at $V_{CB} = 10\text{ V}$, $I_E = 0$	μA			0.1			0.1			0.1
I_{EBO}	Emitter Cutoff Current at $V_{EB} = 1\text{ V}$, $I_C = 0$	μA			0.1			0.1			0.1
h_{FE}	Forward Current Gain at $V_{CE} = 6\text{ V}$, $I_C = 10\text{ mA}$		50	100	250	50	100	250	50	100	250
C_{OB}	Output Capacitance at $V_{CB} = 10\text{ V}$, $I_E = 0$	pF		0.2	1		0.2	0.6		0.3	1
R_{TH}	Thermal Resistance (Junction-to-Ambient)	$^\circ\text{C/W}$			550			550			590
P_T	Total Power Dissipation	W			200			290			250

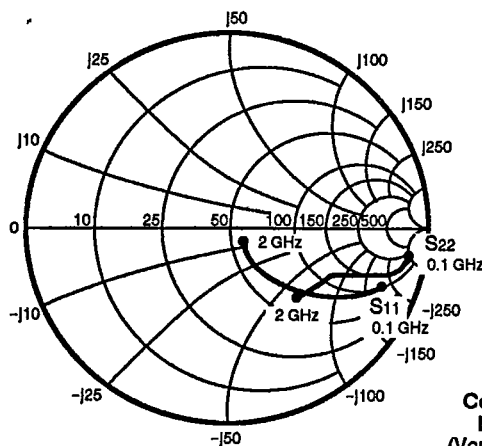
*Electronic Industrial Association of Japan.

OUTLINE DIMENSIONS (Units in mm)**NE68000 (CHIP)**
(Chip Thickness: $160\text{ }\mu\text{m}$)**OUTLINE 33**
(SOT-23)**OUTLINE 35**
(MICRO-X)**OUTLINE 37**
(DISK-MOLD)

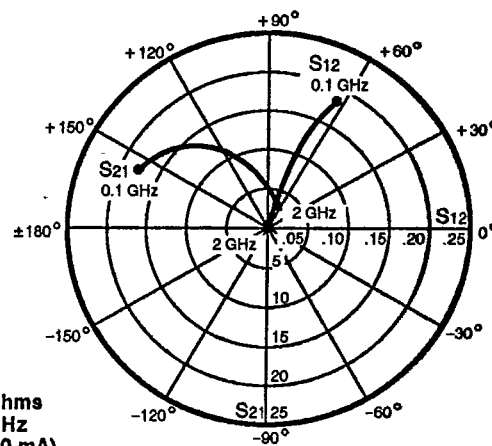
TYPICAL DEVICE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)TYPICAL PERFORMANCE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

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

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68033
Coordinates in Ohms
Frequency in GHz
(VCE = 6 V, IC = 10 mA)

**S-MAGN AND ANGLES:****VCE = 6 V, IC = 5 mA****FREQUENCY (MHz)**

	S11		S21		S12		S22	
100	.91	-14	11.79	163	.00	101	.95	-8
200	.79	-26	10.85	144	.00	80	.89	-15
400	.60	-41	8.14	122	.03	67	.75	-23
600	.48	-50	6.50	109	.05	66	.68	-27
800	.38	-57	5.23	98	.07	64	.62	-29
1000	.30	-63	4.37	91	.09	63	.60	-33
1200	.24	-62	3.76	84	.11	63	.57	-36
1400	.22	-61	3.26	79	.13	63	.57	-37
1600	.20	-62	2.93	74	.15	63	.58	-41
1800	.20	-62	2.62	70	.17	62	.57	-44
2000	.16	-64	2.45	64	.18	59	.54	-47

VCE = 6 V, IC = 10 mA

	S11		S21		S12		S22	
100	.81	-21	18.11	155	.00	102	.92	-10
200	.63	-35	15.01	132	.00	80	.81	-18
400	.42	-46	9.80	111	.02	69	.67	-22
600	.33	-50	7.24	100	.04	70	.61	-24
800	.26	-55	5.68	91	.06	69	.57	-25
1000	.19	-61	4.67	84	.09	68	.57	-30
1200	.16	-64	3.95	79	.11	68	.55	-32
1400	.15	-61	3.41	75	.13	67	.55	-34
1600	.14	-62	3.05	70	.15	66	.56	-38
1800	.15	-60	2.72	67	.17	65	.55	-42
2000	.11	-62	2.52	62	.18	63	.53	-45

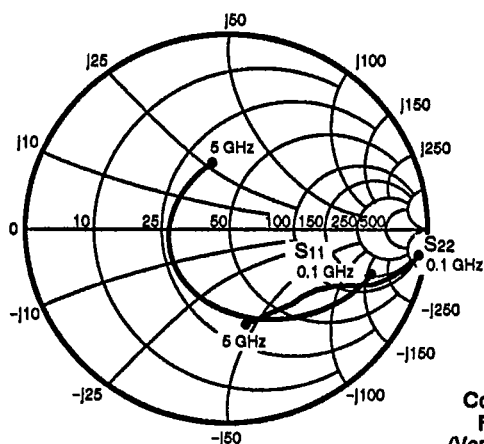
VCE = 6 V, IC = 15 mA

	S11		S21		S12		S22	
100	.74	-26	21.09	150	.00	98	.89	-11
200	.53	-40	16.30	126	.00	84	.78	-17
400	.33	-51	9.96	106	.02	72	.64	-20
600	.25	-52	7.17	96	.04	72	.60	-22
800	.19	-56	5.57	88	.06	71	.58	-23
1000	.14	-64	4.54	82	.09	71	.57	-28
1200	.10	-56	3.85	76	.11	70	.56	-31
1400	.10	-51	3.34	73	.12	69	.56	-33
1600	.08	-51	2.97	68	.14	68	.57	-37
1800	.10	-48	2.65	65	.16	67	.57	-41
2000	.05	-49	2.45	60	.18	64	.54	-44

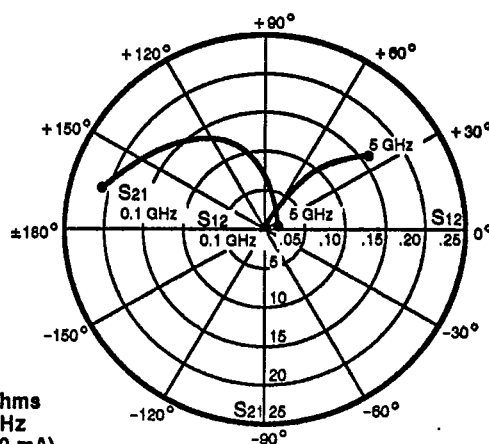
VCE = 6 V, IC = 20 mA

	S11		S21		S12		S22	
100	.66	-32	21.27	146	.00	97	.87	-11
200	.44	-48	15.60	122	.00	85	.76	-16
400	.25	-59	9.21	103	.01	72	.65	-18
600	.18	-62	6.54	94	.04	73	.62	-19
800	.13	-68	5.06	86	.05	72	.60	-22
1000	.08	-86	4.15	81	.08	72	.60	-27
1200	.02	-79	3.52	75	.10	72	.58	-30
1400	.02	-63	3.05	72	.12	71	.59	-32
1600	.01	-100	2.73	67	.14	69	.60	-37
1800	.02	-36	2.42	64	.16	69	.60	-40
2000	.01	-170	2.25	59	.17	66	.57	-44

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68035
Coordinates in Ohms
Frequency in GHz
(VCE = 6 V, IC = 10 mA)



S-MAGN AND ANGLES:

VCE = 6 V, IC = 5 mA

FREQUENCY (MHz)

	S11	S21	S12	S22
100	.84 -13	12.98 169	.00 157	.99 -5
500	.65 -63	10.85 131	.01 61	.79 -24
1000	.46 -103	7.19 102	.03 51	.64 -32
1500	.37 -127	5.19 86	.05 49	.65 -37
2000	.30 -150	4.07 72	.05 44	.59 -42
2500	.31 -177	3.23 62	.09 44	.55 -45
3000	.30 165	2.78 51	.10 43	.54 -53
3500	.30 150	2.43 39	.11 39	.53 -59
4000	.32 137	2.19 32	.13 38	.53 -68
4500	.33 124	1.95 24	.14 37	.53 -74
5000	.35 114	1.80 14	.16 32	.53 -83

VCE = 6 V, IC = 10 mA

	S11	S21	S12	S22
100	.72 -20	20.47 165	.00 158	.97 -7
500	.49 -87	13.90 119	.00 63	.69 -25
1000	.35 -128	8.14 94	.01 56	.57 -30
1500	.29 -148	5.65 80	.03 58	.60 -34
2000	.27 -172	4.38 68	.04 53	.55 -37
2500	.30 161	3.49 58	.09 52	.51 -44
3000	.30 147	2.95 48	.10 50	.50 -50
3500	.31 135	2.59 37	.11 46	.51 -56
4000	.33 125	2.32 30	.13 44	.51 -66
4500	.35 114	2.05 23	.15 42	.51 -72
5000	.37 106	1.89 13	.16 37	.51 -81

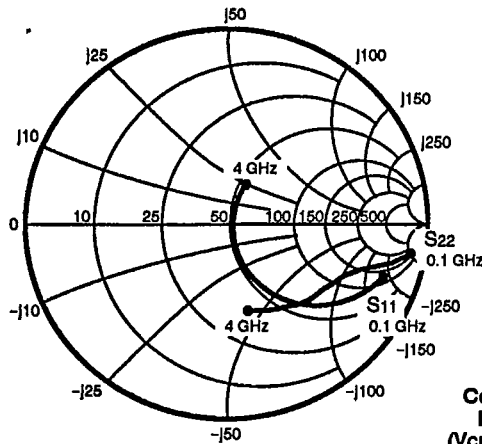
VCE = 6 V, IC = 15 mA

	S11	S21	S12	S22
100	.63 -26	24.77 161	.00 152	.95 -8
500	.41 -104	14.52 113	.00 75	.65 -24
1000	.33 -143	8.07 90	.01 65	.56 -27
1500	.30 -163	5.55 77	.03 61	.60 -31
2000	.28 177	4.26 65	.04 57	.56 -35
2500	.31 152	3.34 57	.08 56	.53 -42
3000	.33 143	2.90 46	.09 54	.51 -49
3500	.34 131	2.51 36	.11 50	.52 -55
4000	.36 122	2.24 29	.12 47	.52 -64
4500	.37 112	1.99 22	.14 46	.53 -71
5000	.39 104	1.83 12	.16 40	.53 -79

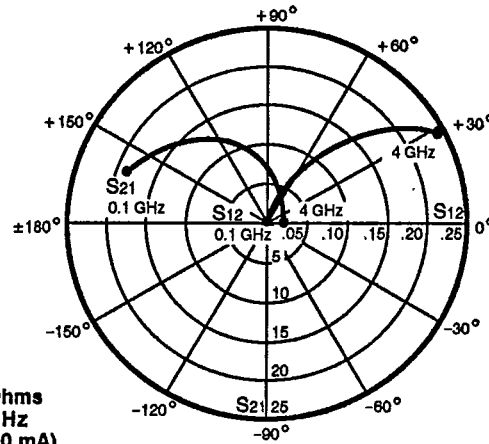
VCE = 6 V, IC = 20 mA

	S11	S21	S12	S22
100	.55 -34	26.43 158	.00 152	.94 -8
500	.39 -121	13.59 109	.00 83	.65 -21
1000	.34 -158	7.37 87	.01 70	.58 -24
1500	.32 -175	5.00 75	.02 64	.62 -29
2000	.31 168	3.87 64	.03 62	.60 -34
2500	.35 148	3.08 55	.08 60	.56 -41
3000	.37 138	2.62 45	.09 58	.55 -47
3500	.38 128	2.28 35	.11 53	.56 -55
4000	.40 119	2.05 28	.12 51	.55 -64
4500	.41 109	1.80 21	.14 49	.56 -70
5000	.43 101	1.67 11	.15 43	.56 -79

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE68037
Coordinates in Ohms
Frequency in GHz
(Vce = 6 V, Ic = 10 mA)

**S-MAGN AND ANGLES:****VCE = 6 V, IC = 5 mA**

FREQUENCY (MHz)

	S11		S21		S12		S22	
100	.91	-12	12.03	166	.00	156	.97	-6
500	.59	-52	8.91	121	.02	65	.75	-22
1000	.33	-71	5.48	91	.05	60	.63	-29
1500	.20	-76	3.91	74	.09	56	.65	-35
2000	.09	-78	3.07	58	.12	48	.58	-42
2500	.01	89	2.47	46	.16	44	.55	-50
3000	.07	76	2.16	34	.18	39	.53	-58
3500	.13	73	1.92	21	.21	31	.50	-67
4000	.19	67	1.74	11	.23	27	.48	-77

VCE = 6 V, IC = 10 mA

	S11		S21		S12		S22	
100	.82	-18	18.69	160	.00	159	.95	-7
500	.40	-62	10.56	109	.01	68	.67	-21
1000	.19	-73	5.87	84	.04	64	.59	-26
1500	.10	-66	4.07	69	.08	62	.63	-31
2000	.02	28	3.17	54	.12	52	.58	-39
2500	.08	64	2.57	44	.15	48	.55	-47
3000	.13	67	2.21	31	.18	42	.52	-57
3500	.18	64	1.95	19	.21	34	.50	-65
4000	.23	60	1.76	10	.23	29	.47	-77

VCE = 6 V, IC = 15 mA

	S11		S21		S12		S22	
100	.74	-23	22.00	155	.00	154	.93	-8
500	.29	-71	10.59	103	.01	68	.66	-19
1000	.12	-84	5.69	81	.04	67	.60	-23
1500	.01	-63	3.88	66	.08	62	.64	-30
2000	.02	76	3.02	52	.11	54	.59	-37
2500	.12	76	2.44	41	.15	51	.56	-46
3000	.16	72	2.11	30	.18	45	.54	-56
3500	.21	66	1.86	19	.21	37	.52	-65
4000	.26	62	1.69	8	.23	32	.49	-77

VCE = 6 V, IC = 20 mA

	S11		S21		S12		S22	
100	.66	-30	22.17	151	.00	157	.91	-8
500	.22	-90	9.42	100	.01	72	.67	-17
1000	.07	-130	4.99	79	.04	68	.62	-22
1500	.01	118	3.42	65	.07	65	.67	-29
2000	.08	94	2.67	51	.10	58	.63	-37
2500	.17	84	2.13	41	.15	54	.60	-45
3000	.22	77	1.84	28	.17	49	.58	-55
3500	.27	68	1.63	17	.21	41	.56	-65
4000	.32	61	1.47	7	.23	36	.53	-77