



# NPN MEDIUM POWER UHF-VHF TRANSISTOR

**NE74000**  
**NE74014**  
**NE74020**

## FEATURES

- HIGH GAIN BANDWIDTH PRODUCT:  $f_r = 2.2$  GHz
- EXCELLENT INTERMODULATION CHARACTERISTICS AT HIGH OUTPUT LEVELS
- LOW NOISE FIGURE: 3.5 dB at 200 MHz
- EXCELLENT WIDE BAND CATV AMPLIFIER

## DESCRIPTION AND APPLICATIONS

The NE740 series of NPN silicon transistors is designed for wide bandwidth VHF and UHF amplifiers. Excellent intermodulation characteristics and low noise make the series a widely used general purpose low to medium power transistor. (The NE90115 is the PNP complement.) The series is available as a chip and in a variety of reliable packages. The NE74014 (2SC1253) and NE74020 (2SC1251) are screened to NEC's Grade C level of reliability which make the devices very attractive for military and industrial applications requiring MTBF's greater than  $10^6$  hours. The series reliability is assured by NEC's Pt-Si/Ti/Pt/Au metallization system and quality control procedures which are patterned after MIL-S-19500.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub>	Collector to Base Voltage	V	45
V <sub>CE0</sub>	Collector to Emitter Voltage	V	25
V <sub>EB0</sub>	Emitter to Base Voltage	V	3
I <sub>c</sub>	Collector Current	mA	300
T <sub>J</sub>	Junction Temperature	°C	200
T <sub>STG</sub>	Storage Temperature	°C	-65 to +175

## PERFORMANCE SPECIFICATIONS (T<sub>A</sub> = 25°C)

PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE			NE74000 00 (CHIP)			NE74014 2SC1253 14 (TO-39)			NE74020 2SC1251 20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f <sub>r</sub>	Gain Bandwidth Product at V <sub>CE</sub> = 15 V, I <sub>c</sub> = 50 mA	GHz	1.8	2.2		1.8	2		1.8	2.2	
S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain at V <sub>CE</sub> = 10 V, I <sub>c</sub> = 50 mA, f = 0.2 GHz f = 0.5 GHz f = 1 GHz	dB dB dB		17 10 5			17 10 5			17 10 5	
NF <sub>MIN</sub>	Minimum Noise Figure at V <sub>CE</sub> = 15 V, I <sub>c</sub> = 50 mA, R <sub>g</sub> = 50 Ω, f = 200 MHz at V <sub>CE</sub> = 16 V, I <sub>c</sub> = 5 mA <sup>2</sup> , f = 200 MHz	dB dB		3.5	4		3.5	4		3.5	4
MAG	Maximum Available Gain <sup>3</sup> at V <sub>CE</sub> = 15 V, I <sub>c</sub> = 50 mA f = 0.2 GHz f = 0.5 GHz f = 1 GHz	dB dB dB	14	18 11 6		14	18 11 6		14	18 11 6	
P <sub>1dB</sub>	Power Output at 1 dB Compression Point at V <sub>CE</sub> = 15 V, I <sub>c</sub> = 100 mA, f = 1 GHz	dBm		29						29	

**Notes:**

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

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

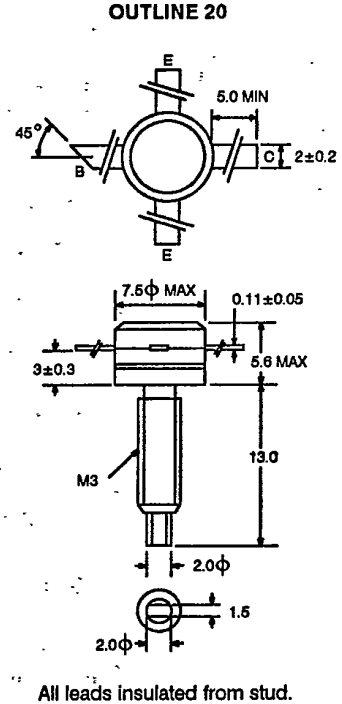
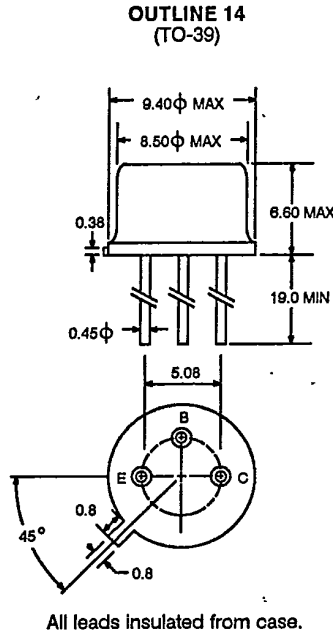
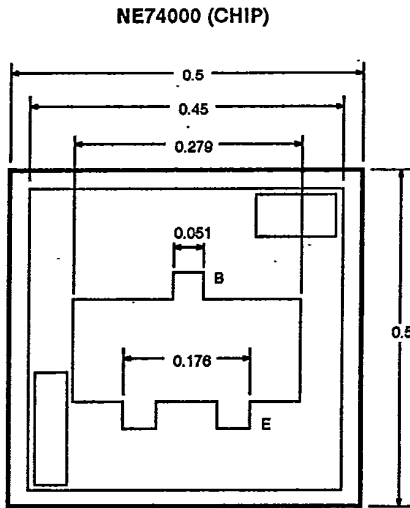
PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE			NE74000 00 (CHIP)			NE74014 2SC1253 14 (TO-39)			NE74020 2SC1251 20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Icbo	Collector Cutoff Current at Vcb = 30 V, Ie = 0	μA			0.1			0.1			0.1
Iebo	Emitter Cutoff Current at Veb = 2 V, Ic = 0	μA			0.5			0.5			0.5
hFE	Forward Current Gain <sup>2</sup> at Vce = 10 V, Ic = 50 mA		20	100	200	20	100	200	20	100	200
Cob	Output Capacitance <sup>3</sup> at Vcb = 15 V, Ie = 0, f = 1 MHz	pF		2	3		2	3		2	3
Rth	Thermal Resistance (Junction-to-Case)	°C/W			22			30			35
Pt	Total Power Dissipation <sup>4</sup> (Tc = 25°C)	W			7			5			5

**Notes:**

1. Electronic Industrial Association of Japan.
2. Pulse Width ≤ .350 μs, Duty Cycle ≤ 2%/pulsed.
3. The emitter and stud are grounded.

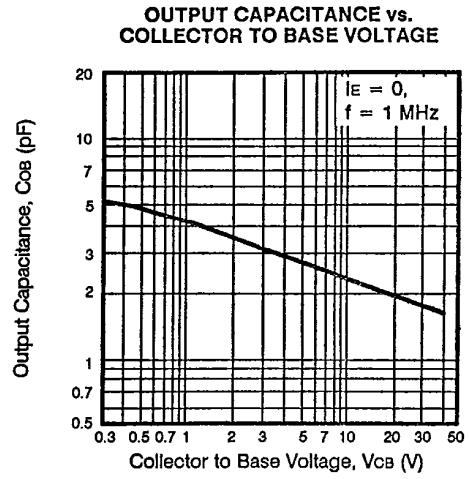
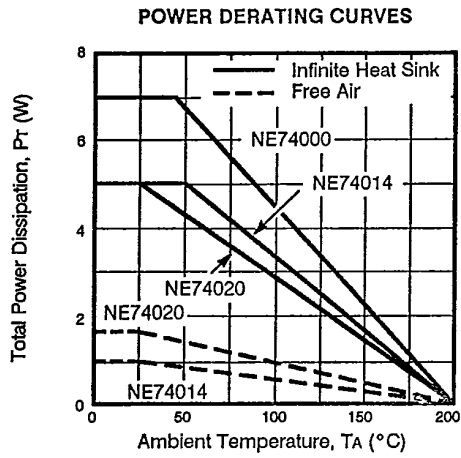


**OUTLINE DIMENSIONS** (Units in mm)

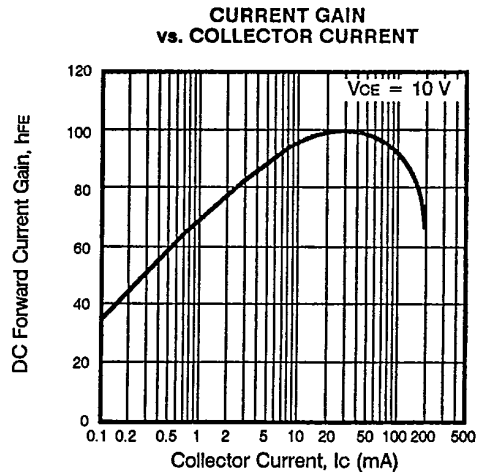
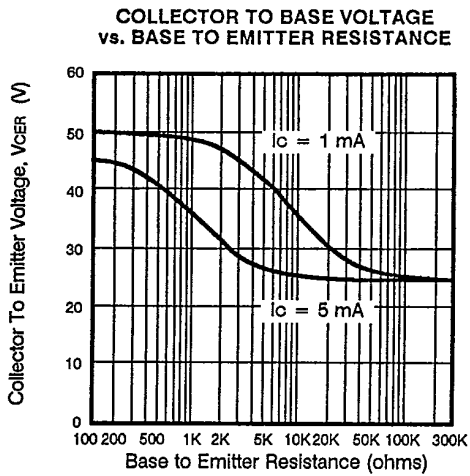
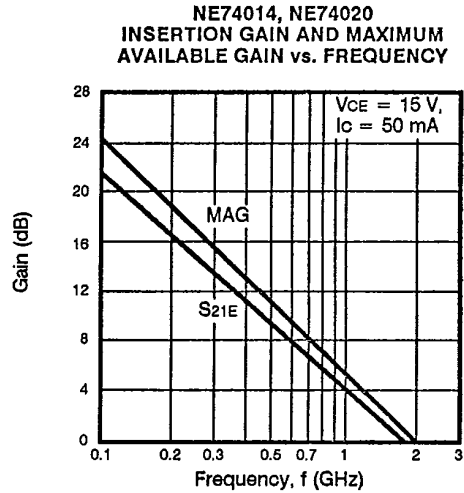
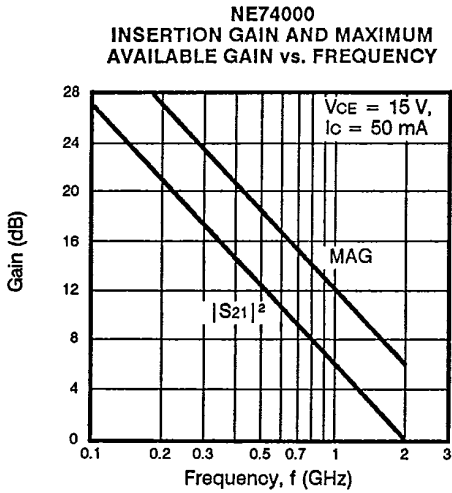


NE74000, NE74014, NE74020

TYPICAL DEVICE CHARACTERISTICS (TA = 25°C)

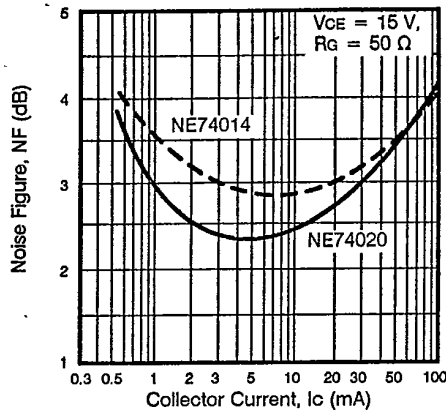


TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)

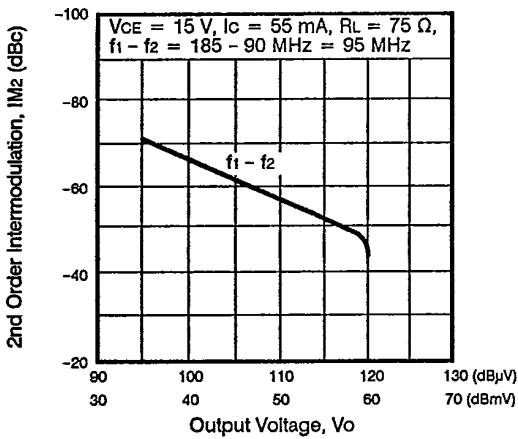


TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)

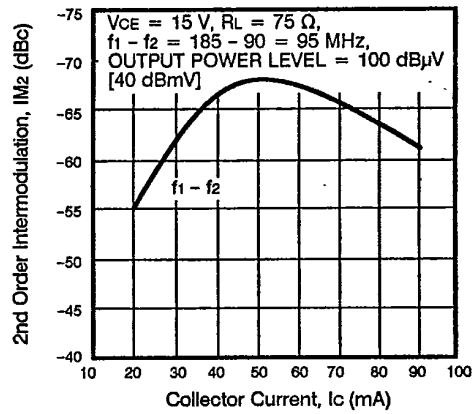
NOISE FIGURE vs. COLLECTOR CURRENT



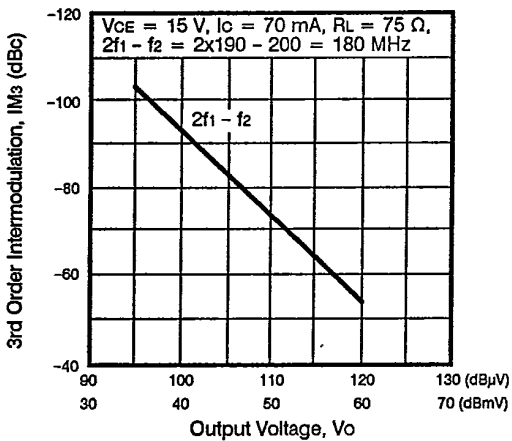
NE74014  
2ND ORDER INTERMODULATION DISTORTION vs. OUTPUT VOLTAGE



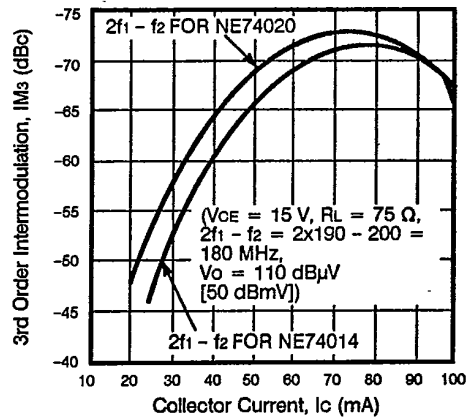
NE74020  
2ND ORDER INTERMODULATION DISTORTION vs. COLLECTOR CURRENT



NE74020  
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT VOLTAGE

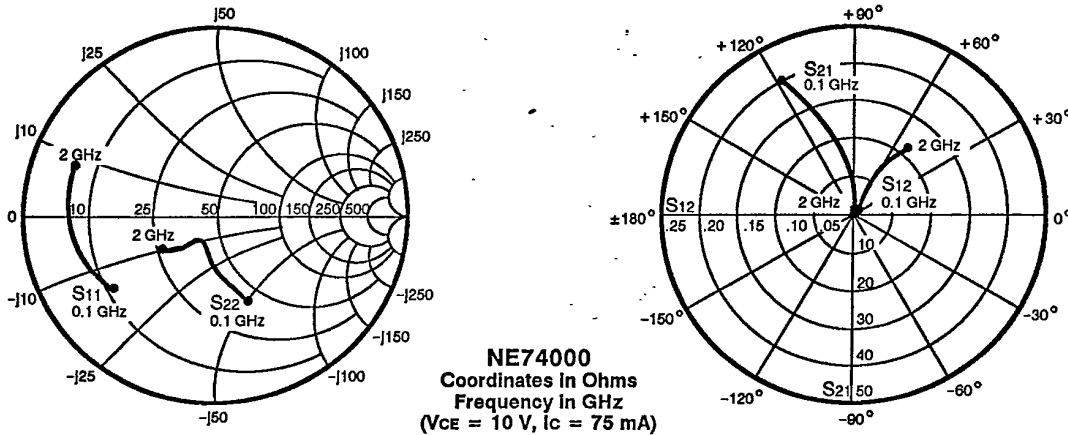


NE74014, NE74020  
3RD ORDER INTERMODULATION DISTORTION vs. COLLECTOR CURRENT



NE74000, NE74014, NE74020

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



S-MAGN AND ANGLES:

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 25 mA

FREQUENCY (MHz)	S <sub>11</sub>	S <sub>21</sub>	S <sub>12</sub>	S <sub>22</sub>
100	.72 -144	19.85 109	.03 37	.39 -74
200	.74 -163	10.40 95	.03 39	.22 -92
400	.75 -175	5.26 82	.04 47	.16 -106
600	.75 180	3.52 73	.06 50	.16 -113
800	.75 176	2.65 64	.07 50	.17 -116
1000	.76 173	2.11 57	.08 49	.19 -120
1200	.76 170	1.76 49	.09 47	.22 -123
1400	.76 168	1.50 43	.10 46	.25 -127
1600	.76 166	1.31 35	.11 44	.28 -132
1800	.76 163	1.17 29	.11 42	.31 -136
2000	.76 161	1.04 23	.12 40	.34 -141

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 50 mA

100	.73 -158	21.47 104	.02 39	.30 -89
200	.76 -170	10.93 92	.02 46	.18 -110
400	.76 -178	5.49 81	.04 56	.15 -127
600	.77 178	3.67 73	.05 57	.16 -131
800	.77 175	2.75 65	.06 56	.17 -133
1000	.77 172	2.20 58	.07 54	.19 -134
1200	.76 169	1.83 51	.08 52	.21 -136
1400	.77 167	1.56 44	.09 51	.24 -139
1600	.77 164	1.36 37	.10 49	.27 -142
1800	.77 162	1.21 32	.11 47	.29 -145
2000	.77 159	1.09 25	.12 46	.32 -149

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 75 mA

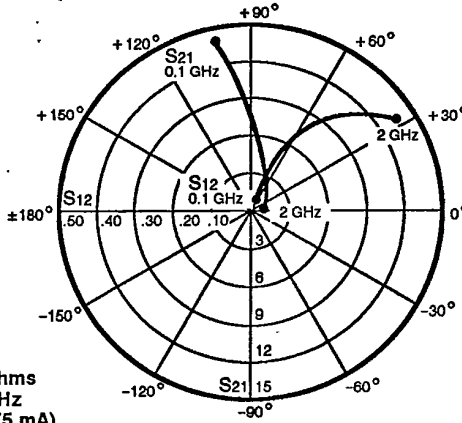
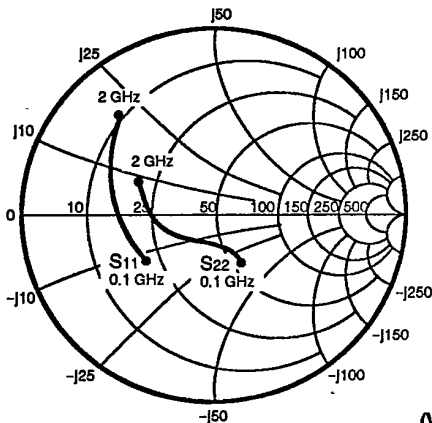
100	.74 -163	21.34 102	.02 43	.26 -92
200	.76 -173	10.78 91	.02 52	.17 -113
400	.77 -179	5.42 81	.03 59	.14 -128
600	.77 177	3.62 73	.05 60	.16 -131
800	.78 174	2.73 65	.06 58	.17 -133
1000	.78 171	2.19 58	.07 57	.19 -135
1200	.78 169	1.82 51	.08 55	.22 -137
1400	.78 166	1.55 44	.09 53	.24 -140
1600	.78 164	1.36 37	.10 51	.27 -144
1800	.78 161	1.20 32	.11 50	.30 -147
2000	.78 159	1.09 26	.11 48	.32 -150

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 100 mA

100	.74 -166	20.15 101	.01 45	.24 -87
200	.76 -174	10.14 91	.02 54	.15 -104
400	.77 -180	5.10 81	.03 61	.14 -119
600	.78 177	3.43 73	.05 61	.16 -124
800	.78 174	2.59 65	.06 59	.18 -127
1000	.79 171	2.06 58	.07 57	.20 -131
1200	.79 169	1.72 51	.08 56	.22 -134
1400	.79 166	1.48 44	.09 54	.25 -138
1600	.79 164	1.30 38	.10 53	.28 -142
1800	.78 161	1.15 31	.10 51	.31 -145
2000	.79 159	1.03 25	.11 49	.33 -149

NOTE: S-Parameters include bond wires.  
 BASE: Total 1 wire (s), 1 per bond pad, 0.0250" (636 μm) long each wire.  
 COLLECTOR: Total 1 wire (s), 1 per bond pad, 0.0182" (463 μm) long each wire.  
 EMITTER: Total 2 wire (s), 1 per side, 0.0456" (1157 μm) long each wire.  
 WIRE: 0.0007" (17.7 μm) dia., gold.

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



**NE74014**  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 75 mA)

**S-MAGN AND ANGLES:**

VCE = 10 V, IC = 25 mA

FREQUENCY (MHz)	S11		S21		S12		S22	
100	.44	-132	13.68	105	.03	56	.36	-59
200	.46	-155	7.33	90	.07	61	.24	-70
400	.48	-173	3.86	75	.12	64	.17	-86
600	.50	178	2.69	63	.17	63	.18	-105
800	.53	171	2.10	52	.22	59	.20	-123
1000	.56	164	1.78	42	.26	54	.23	-139
1200	.60	157	1.55	34	.31	50	.26	-154
1400	.63	150	1.39	25	.35	45	.30	-170
1600	.65	143	1.25	18	.38	41	.34	179
1800	.68	136	1.15	11	.41	36	.39	165
2000	.72	130	1.06	6	.44	32	.44	155

VCE = 10 V, IC = 50 mA

100	.43	-143	14.34	102	.03	60	.30	-62
200	.45	-161	7.59	88	.06	64	.20	-74
400	.48	-176	3.96	74	.12	67	.15	-91
600	.50	177	2.74	63	.17	64	.16	-109
800	.53	170	2.14	52	.22	60	.19	-127
1000	.56	164	1.81	42	.26	55	.22	-141
1200	.60	157	1.57	35	.31	50	.25	-155
1400	.63	150	1.41	26	.35	46	.29	-170
1600	.65	144	1.28	18	.38	41	.33	179
1800	.68	137	1.17	12	.41	36	.38	166
2000	.71	130	1.09	7	.44	32	.43	156

VCE = 10 V, IC = 75 mA

100	.43	-147	14.06	100	.02	60	.28	-60
200	.46	-163	7.39	87	.06	67	.19	-70
400	.48	-177	3.88	74	.12	67	.15	-86
600	.51	176	2.68	62	.17	65	.16	-104
800	.53	170	2.08	52	.22	60	.19	-123
1000	.57	163	1.77	41	.26	55	.22	-137
1200	.60	156	1.53	33	.30	51	.26	-152
1400	.64	149	1.37	25	.35	46	.29	-168
1600	.66	143	1.24	17	.38	41	.34	-179
1800	.68	136	1.14	11	.41	37	.38	167
2000	.72	129	1.05	6	.44	33	.43	157

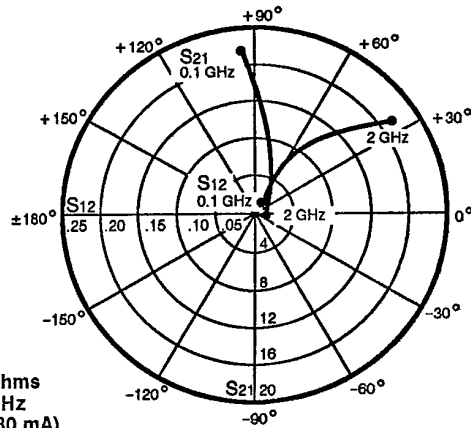
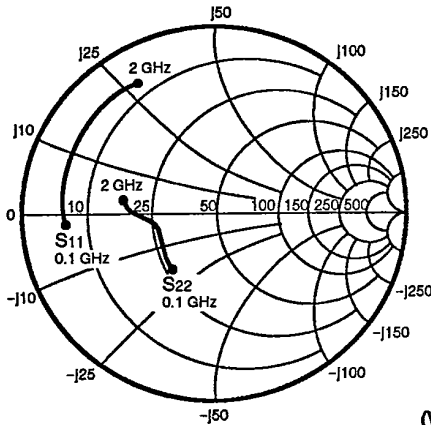
VCE = 10 V, IC = 100 mA

100	.45	-154	12.87	99	.02	62	.29	-49
200	.48	-167	6.77	87	.06	66	.22	-55
400	.50	-180	3.55	73	.11	69	.18	-72
600	.53	174	2.47	61	.16	67	.20	-91
800	.55	167	1.92	50	.21	62	.23	-112
1000	.58	161	1.64	40	.26	57	.26	-130
1200	.62	154	1.42	32	.30	53	.30	-146
1400	.65	147	1.27	24	.35	48	.33	-163
1600	.67	141	1.14	16	.39	43	.37	-176
1800	.70	134	1.05	10	.41	39	.42	170
2000	.73	127	.97	5	.44	34	.47	158



NE74000, NE74014, NE74020

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE74020  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 80 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 40 mA

FREQUENCY (MHz)	S11		S21		S12		S22	
100	.76	-169	16.57	97	.02	42	.37	-116
200	.79	179	8.66	84	.03	53	.29	-141
400	.79	168	4.35	70	.05	56	.27	-158
600	.79	161	2.89	60	.07	54	.28	-164
800	.78	154	2.16	49	.09	53	.31	-165
1000	.79	147	1.74	39	.11	49	.32	-169
1200	.78	142	1.47	31	.13	45	.35	-171
1400	.79	136	1.29	22	.14	44	.38	-176
1600	.78	130	1.13	14	.16	38	.41	-177
1800	.78	126	1.01	8	.18	35	.43	-180
2000	.78	120	.93	1	.21	32	.46	178

VCE = 10 V, IC = 60 mA

100	.77	-174	17.09	95	.02	47	.36	-124
200	.80	177	8.87	84	.02	57	.30	-148
400	.80	166	4.45	70	.05	60	.29	-163
600	.80	160	2.94	60	.07	57	.30	-168
800	.78	153	2.21	49	.09	55	.32	-170
1000	.79	147	1.78	40	.11	52	.33	-173
1200	.79	142	1.51	32	.13	49	.36	-175
1400	.79	136	1.32	23	.14	44	.37	-179
1600	.79	130	1.16	15	.17	39	.41	-180
1800	.78	125	1.04	9	.18	37	.43	177
2000	.79	120	.96	2	.21	34	.45	176

VCE = 10 V, IC = 80 mA

100	.77	-177	17.30	94	.02	47	.35	-127
200	.79	176	8.92	83	.02	62	.30	-152
400	.80	166	4.48	70	.05	65	.29	-165
600	.79	160	2.96	60	.07	59	.30	-171
800	.79	153	2.23	50	.09	57	.32	-172
1000	.79	146	1.79	40	.11	53	.34	-175
1200	.79	141	1.51	32	.13	48	.36	-177
1400	.81	136	1.33	23	.14	45	.38	180
1600	.79	130	1.17	16	.16	40	.41	179
1800	.80	125	1.05	10	.19	38	.43	176
2000	.79	120	.97	3	.21	35	.45	174

VCE = 10 V, IC = 100 mA

100	.78	-178	17.26	94	.01	54	.35	-130
200	.80	175	8.93	83	.02	61	.30	-153
400	.80	166	4.45	70	.05	63	.29	-166
600	.80	159	2.94	60	.07	59	.30	-171
800	.80	153	2.21	50	.09	58	.32	-172
1000	.80	147	1.77	40	.11	54	.33	-176
1200	.80	141	1.50	33	.13	49	.36	-177
1400	.81	136	1.32	23	.15	46	.38	179
1600	.79	130	1.15	16	.16	41	.41	178
1800	.79	125	1.04	10	.19	39	.43	176
2000	.79	119	.96	3	.21	35	.45	174