



# NPN MEDIUM POWER MICROWAVE TRANSISTOR

T-33-05  
NE57500  
NE57510  
NE57520

## FEATURES

- **HIGH OSCILLATOR POWER OUTPUT:**  
700 mW at 1.7 GHz
- **GOLD METALLIZATION FOR RELIABILITY**
- **HIGH POWER GAIN:**  
4 dB at 2 GHz ( $V_{CC} = 18\text{ V}$ )
- **HIGH POWER OUTPUT:**  
1.6 W at 2 GHz ( $V_{CC} = 18\text{ V}$ )

## DESCRIPTION AND APPLICATIONS

The NE575 series of NPN silicon medium power transistors is designed to operate in amplifiers and oscillators up to 2 GHz with supply voltages up to 18 volts. Transistors in this series are available in either a low-inductance can (TO-46), an economical stud-stripline (NE57520), or in chip form. The NE575 series employs NEC's titanium-platinum-gold metallization system. This unique metallization system, with NEC's stringent quality control procedures, yields the utmost in reliability and uniformity and eliminates many of the problems associated with aluminum and moly-gold metallization. This feature also allows for high temperature (100°C) operation at rated dissipation. The NE57520 (2SC1042) is processed and screened to NEC's Grade C (military) level of reliability which is patterned after MIL-S-19500. The Grade D (industrial) version is the 2SC1642.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
$V_{CBO}$	Collector to Base Voltage	V	40
$V_{CEO}$	Collector to Emitter Voltage	V	20 <sup>3</sup>
$V_{EBO}$	Emitter to Base Voltage	V	3
$I_{C(DC)}$	Collector Current (DC)	mA	250
$I_{C(PEAK)}$	Collector Current (Peak)	mA	750
$T_J$	Junction Temperature	°C	200
$T_{STG}$	Storage Temperature	°C	-65 to +200

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

PART NUMBER			NE57500			NE57510			NE57520		
EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE			00(CHIP)			2SC1600-Grd D 10 (TO-46)			2SC1042-Grd C 2SC1642-Grd D 20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
$f_T$	Gain Bandwidth Product ( $T_C = 25^\circ\text{C}$ ) at $V_{CE} = 10\text{ V}$ , $I_C = 100\text{ mA}$	GHz	1.6	2		1.6	2		1.6	2	
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 10\text{ V}$ , $I_C = 100\text{ mA}$ , $f = 1\text{ GHz}$	dB		3.5			3.5			3.5	
$P_{OUT}$	Power Output at $V_{CC} = 18\text{ V}$ , $I_C = 125\text{ mA}$ , $f = 2\text{ GHz}$ , $P_{IN} = 630\text{ mW}$	W	1.4	1.6		1.4	1.6		1.4	1.6	
$P_{OSC}$	Oscillator Output Power at $V_{CC} = 18\text{ V}$ , $I_C = 150\text{ mA}$ , $f = 1.7\text{ GHz}$	mW		700			700			700	
$G_P$	Power Gain at $V_{CC} = 18\text{ V}$ , $I_C = 100\text{ mA}$ , $P_{IN} = 28\text{ dBm}$ , $f = 2\text{ GHz}$	dB	3.5	4		3.5	4		3.5	4	
$MAG$	Maximum Available Gain at $V_{CE} = 10\text{ V}$ , $I_C = 100\text{ mA}$ , $f = 1\text{ GHz}$	dB		4			8.8			8.8	

### Notes:

1. Electronic Industrial Association of Japan.
2.  $PW \leq 350\ \mu\text{s}$ , duty cycle  $\leq 2\%$  pulsed.
3. Typical  $V_{CER} = 30\text{ V}$  for  $R \leq 300\ \Omega$ .

**NE57500, NE57510, NE57520**

**ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = 25°C)

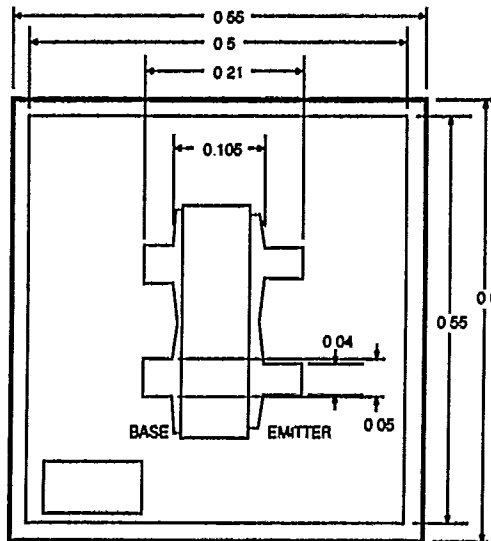
PART NUMBER			NE57500			NE57520 2SC1042-Grd C 2SC1642-Grd D 20			NE57510 2SC1600-Grd D 10 (TO-46)		
EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE			00(CHIP)								
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I <sub>CO</sub>	Collector Cutoff Current at V <sub>CB</sub> = 20 V, I <sub>E</sub> = 0	μA			100			100			100
I <sub>EO</sub>	Emitter Cutoff Current at V <sub>EB</sub> = 2 V, I <sub>C</sub> = 0	μA			100			100			100
h <sub>FE</sub>	Forward Current Gain at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 100 mA <sup>2</sup>		15	80	200	15	80	200	15	80	200
C <sub>CB</sub>	Collector to Base Capacitance <sup>3</sup> at V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, f = 1 MHz	pF		3			4	7		3	4.5
R <sub>θJC</sub>	Thermal Resistance (Junction-to-Case)	°C			20			20			40
P <sub>T</sub>	Total Power Dissipation (T <sub>C</sub> = 25°C)	W			7.5			7.5			4.4

**Notes:**

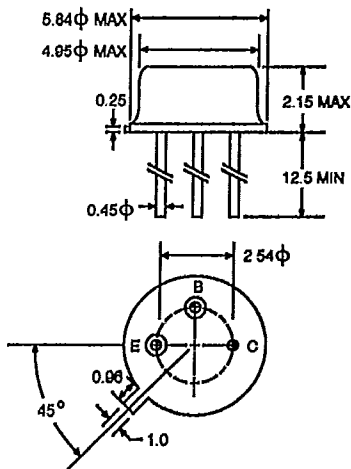
1. Electronic Industrial Association of Japan.
2. PW ≤ 350 μs, duty cycle ≤ 2% pulsed.
3. Emitter is grounded.

**OUTLINE DIMENSIONS** (Units in mm)

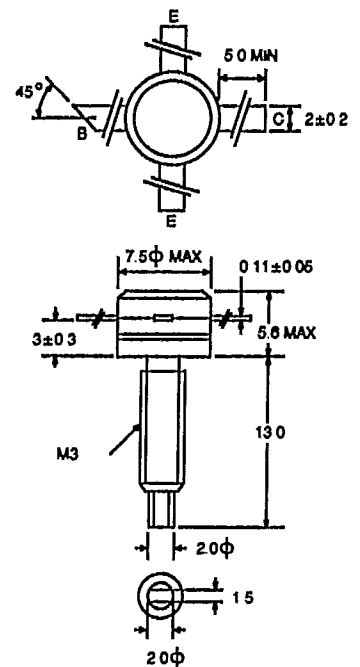
**NE57500 (CHIP)**  
(Chip Thickness: 160 ± 20 μm)



**OUTLINE 10**  
(TO-46)

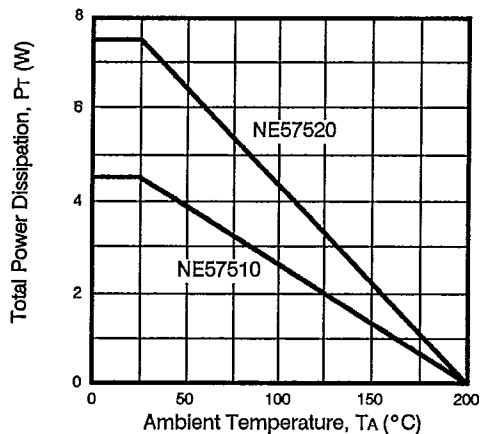


**OUTLINE 20**

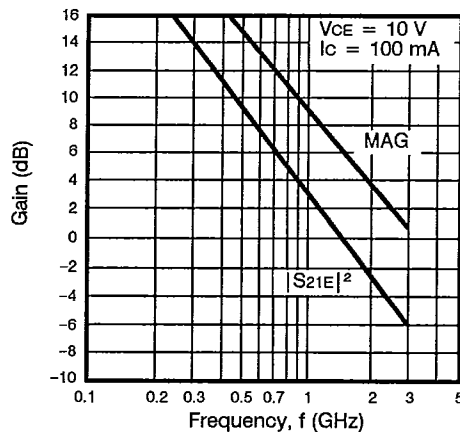


TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)

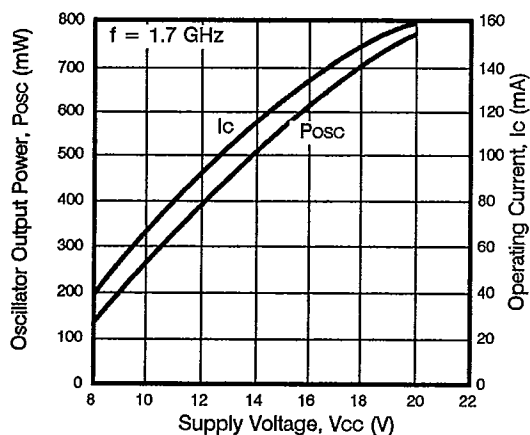
POWER DERATING CURVES



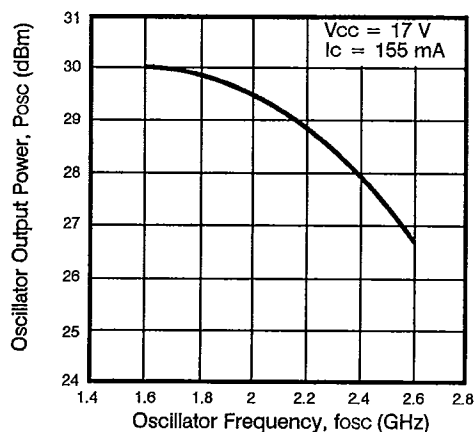
INSERTION GAIN AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY



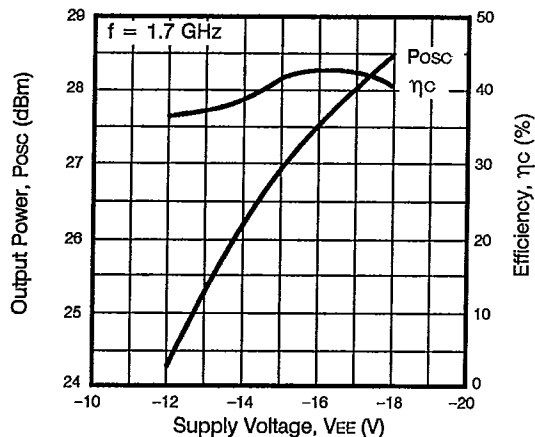
NE57510 OSCILLATOR OUTPUT POWER vs. COLLECTOR VOLTAGE AND COLLECTOR CURRENT



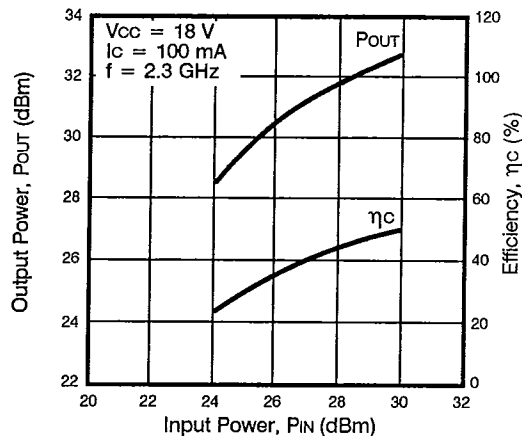
NE57520 OSCILLATOR OUTPUT POWER vs. FREQUENCY



NE57510 OSCILLATOR POWER AND COLLECTOR EFFICIENCY vs. SUPPLY VOLTAGE

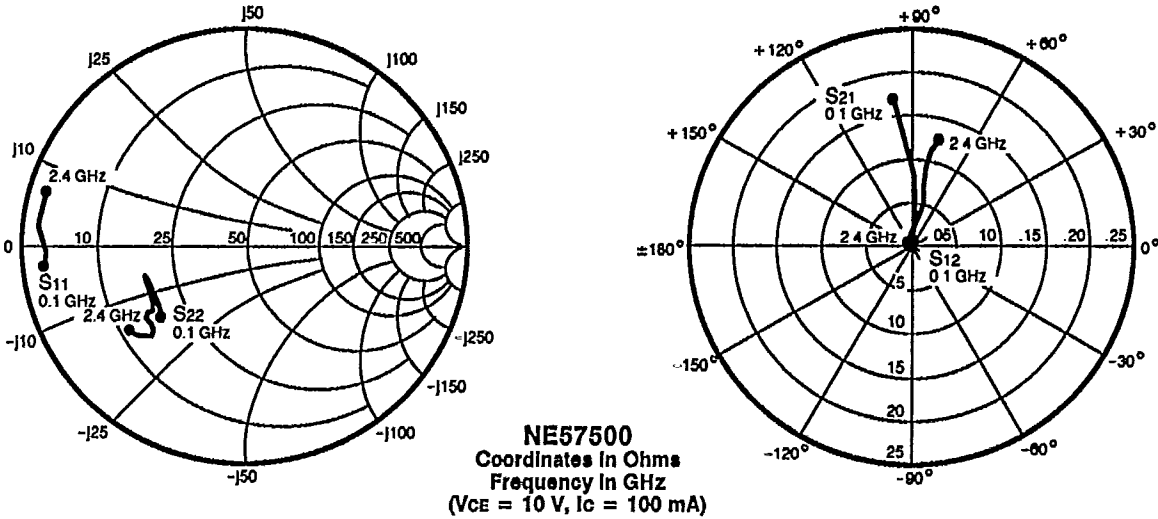


NE57520 POWER OUTPUT AND EFFICIENCY vs. INPUT POWER



NE57500, NE57510, NE57520

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



S-MAGN AND ANGLES:

VCE = 10 V, IC = 50 mA

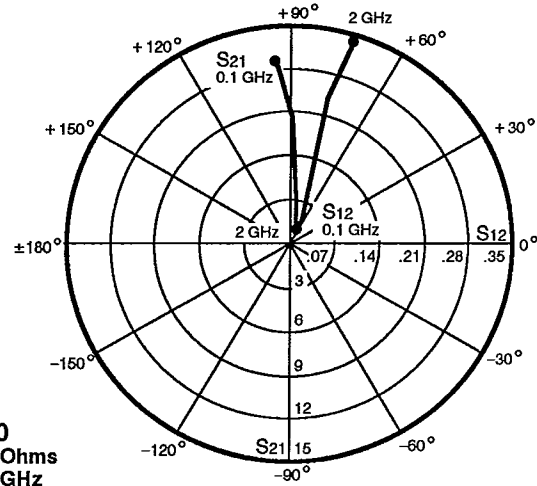
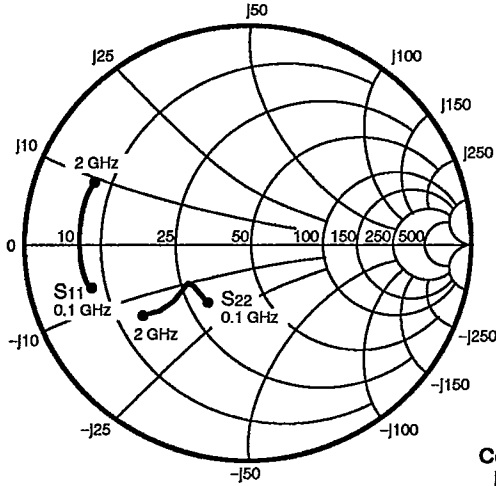
FREQUENCY (MHz)

	S11	S21	S12	S22	K	Gma (dB)
100	.88 -167	15.65 98	.004 9	.29 -124	1.64	31.5
200	.87 -174	7.98 91	.006 34	.25 -142	2.27	24.8
400	.89 -178	3.97 81	.020 59	.26 -151	1.40	19.2
600	.88 179	2.68 75	.031 64	.26 -152	1.39	15.6
800	.87 177	1.97 69	.035 66	.29 -141	1.68	12.7
1000	.88 176	1.60 63	.049 70	.30 -141	1.41	11.3
1200	.88 175	1.35 58	.064 74	.29 -139	1.28	10.0
1400	.87 173	1.16 54	.076 74	.33 -136	1.25	8.8
1600	.87 172	1.03 48	.088 76	.35 -137	1.20	8.0
1800	.87 170	.89 45	.098 77	.39 -137	1.23	6.7
2000	.87 167	.83 38	.108 77	.39 -137	1.15	6.5
2200	.90 165	.75 36	.117 74	.41 -140	.94	8.1
2400	.89 164	.66 32	.130 75	.43 -143	1.03	5.9

VCE = 10 V, IC = 100 mA

100	.88 -171	16.02 96	.004 13	.29 -138	1.66	31.7
200	.88 -176	8.13 90	.006 45	.26 -152	2.39	24.9
400	.89 -179	4.05 81	.013 69	.28 -158	1.95	19.2
600	.88 178	2.73 75	.029 71	.27 -160	1.49	15.5
800	.88 176	2.01 69	.042 72	.28 -148	1.43	13.0
1000	.87 176	1.64 64	.054 75	.29 -148	1.43	11.2
1200	.88 175	1.37 59	.068 75	.28 -145	1.19	10.4
1400	.88 173	1.19 55	.077 77	.31 141	1.24	8.9
1600	.87 171	1.05 48	.089 77	.33 -141	1.21	7.9
1800	.87 170	.92 45	.100 77	.36 -140	1.24	6.7
2000	.87 167	.85 38	.109 77	.37 -139	1.15	6.6
2200	.90 165	.76 36	.119 74	.38 -142	.93	8.1
2400	.89 164	.68 31	.131 75	.41 -144	1.06	5.6

**TYPICAL COMMON EMITTER SCATTERING PARAMETERS**



**NE57510**  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 50 mA)

**S-MAGN AND ANGLES:**

VCE = 10 V, IC = 25 mA

FREQUENCY (MHz)	S11	S21	S12	S22
100	.73 -157	11.48 98	.03 43	.32 -107
200	.74 -169	5.93 88	.04 50	.28 -127
400	.74 -178	3.05 78	.07 66	.28 -133
600	.75 177	2.08 69	.11 67	.32 -135
800	.75 174	1.58 62	.14 71	.37 -135
1000	.76 171	1.32 54	.17 74	.41 -136
1200	.74 167	1.13 50	.20 75	.45 -136
1400	.75 165	.99 47	.24 75	.50 -137
1600	.75 162	.89 42	.27 75	.55 -139
1800	.74 159	.81 40	.29 74	.59 -142
2000	.74 157	.76 40	.33 74	.61 -144

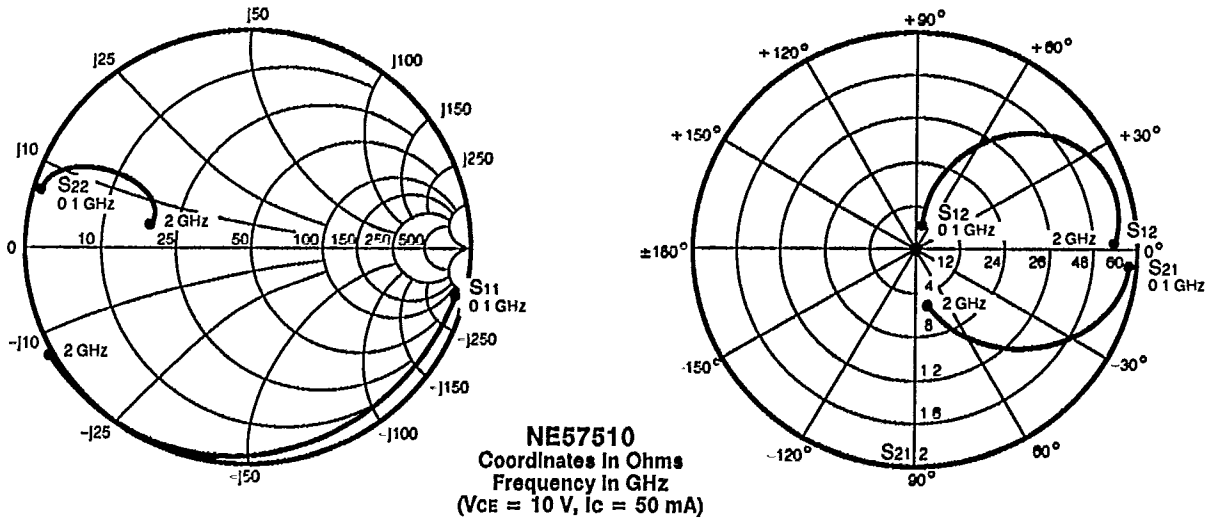
VCE = 10 V, IC = 50 mA

100	.72 -163	12.32 96	.03 46	.32 -125
200	.72 -173	6.35 87	.04 58	.30 -142
400	.73 -179	3.26 78	.08 67	.31 -148
600	.74 176	2.22 70	.11 71	.33 -148
800	.74 172	1.70 63	.15 72	.36 -147
1000	.74 169	1.43 56	.18 72	.39 -145
1200	.73 167	1.25 52	.22 74	.42 -143
1400	.73 164	1.09 48	.25 73	.46 -142
1600	.73 162	.98 43	.28 73	.50 -143
1800	.72 160	.90 40	.30 72	.54 -144
2000	.71 157	.84 40	.33 72	.56 -145

VCE = 10 V, IC = 100 mA

100	.73 -166	12.22 94	.02 52	.31 -133
200	.73 -174	6.28 86	.03 62	.30 -147
400	.73 180	3.23 77	.08 71	.30 -152
600	.74 175	2.20 69	.12 72	.31 -151
800	.74 172	1.70 63	.15 73	.35 -149
1000	.74 169	1.41 55	.18 73	.37 -147
1200	.73 166	1.23 51	.22 72	.40 -144
1400	.72 164	1.08 46	.25 73	.44 -142
1600	.72 162	.96 42	.28 73	.48 -143
1800	.73 160	.88 38	.30 72	.53 -144
2000	.71 156	.83 37	.33 71	.55 -144

**TYPICAL COMMON COLLECTOR SCATTERING PARAMETERS**



**S-MAGN AND ANGLES:**

VCE = 10 V, IC = 25 mA

FREQUENCY (MHz)	S11		S21		S12		S22	
100	.98	-15	1.87	-7	.08	68	.92	173
200	.97	-31	1.80	-17	.19	68	.90	167
400	.97	-58	1.60	-30	.35	56	.81	158
600	.95	-79	1.41	-41	.46	44	.70	151
800	.94	-97	1.21	-50	.52	33	.60	148
1000	.94	-111	1.03	-56	.56	24	.51	151
1200	.97	-120	.89	-60	.59	16	.43	155
1400	.99	-130	.76	-66	.58	10	.40	165
1600	.99	-137	.68	-71	.57	3	.38	175
1800	.98	-144	.56	-77	.55	-6	.40	-178
2000	1.00	-150	.47	-78	.53	-8	.45	-175

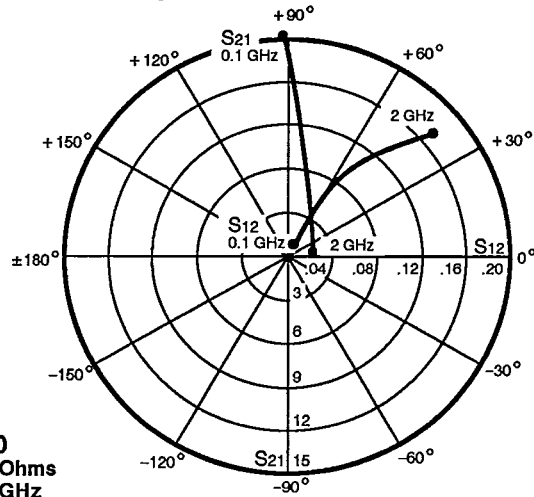
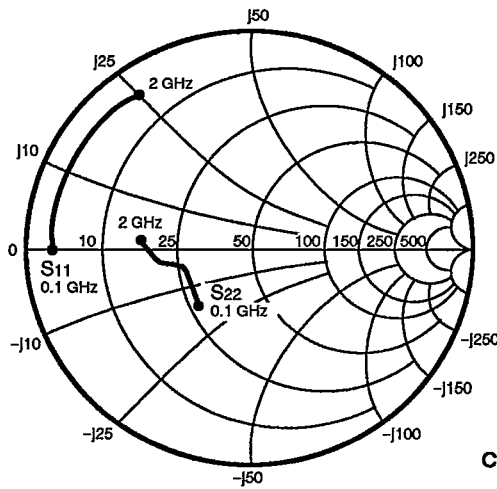
VCE = 10 V, IC = 50 mA

100	.99	-14	1.90	-7	.06	68	.94	174
200	.97	-30	1.82	-16	.15	70	.93	169
400	.98	-55	1.65	-29	.29	60	.87	162
600	.97	-76	1.46	-40	.34	50	.78	155
800	.96	-94	1.28	-50	.46	41	.70	151
1000	.97	-109	1.09	-56	.51	31	.61	150
1200	1.00	-119	.94	-61	.55	24	.53	151
1400	1.01	-129	.80	-68	.55	18	.47	156
1600	1.02	-137	.71	-74	.56	11	.42	162
1800	1.01	-144	.59	-79	.55	2	.41	169
2000	1.02	-150	.49	-81	.54	1	.44	173

VCE = 10 V, IC = 100 mA

100	.99	-15	1.90	-7	.06	70	.95	175
200	.97	-30	1.83	-16	.15	71	.95	170
400	.98	-57	1.65	-29	.28	62	.89	162
600	.97	-78	1.46	-41	.39	51	.81	156
800	.96	-96	1.26	-51	.47	42	.73	151
1000	.97	-111	1.08	-57	.52	33	.65	150
1200	1.01	-120	.91	-62	.56	25	.55	149
1400	1.02	-131	.78	-69	.56	19	.49	154
1600	1.01	-139	.68	-74	.57	12	.43	158
1800	1.00	-145	.56	-80	.56	2	.40	166
2000	1.00	-152	.46	-81	.56	-0	.43	171

**TYPICAL COMMON EMITTER SCATTERING PARAMETERS**



**NE57520**  
Coordinates in Ohms  
Frequency in GHz  
(V<sub>CE</sub> = 10 V, I<sub>C</sub> = 100 mA)

**S-MAGN AND ANGLES:**

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 60 mA

FREQUENCY (MHz)	S <sub>11</sub>	S <sub>21</sub>	S <sub>12</sub>	S <sub>22</sub>
100	.85 -177	14.88 92	.02 36	.33 -126
200	.86 176	7.63 82	.02 46	.27 -148
400	.86 167	3.80 69	.03 56	.26 -160
600	.85 161	2.51 58	.04 59	.28 -163
800	.85 155	1.87 47	.06 56	.30 -165
1000	.85 150	1.50 37	.08 56	.34 -167
1200	.85 144	1.27 29	.10 54	.37 -169
1400	.85 141	1.10 21	.11 54	.40 -172
1600	.86 135	.95 13	.13 47	.44 -175
1800	.87 131	.85 7	.15 47	.47 -178
2000	.87 126	.77 0	.17 43	.50 178

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

100	.85 180	15.48 91	.01 44	.34 -136
200	.87 174	7.92 81	.01 61	.30 -157
400	.86 166	3.94 69	.03 62	.29 -168
600	.85 160	2.60 58	.05 59	.31 -171
800	.85 154	1.94 47	.07 59	.32 -173
1000	.85 150	1.56 38	.08 58	.34 -175
1200	.85 144	1.32 30	.10 55	.37 -176
1400	.85 141	1.15 22	.12 54	.39 -178
1600	.86 135	1.00 14	.13 48	.43 -180
1800	.87 131	.90 8	.15 47	.45 178
2000	.87 126	.82 1	.17 43	.48 175

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 150 mA

100	.86 178	15.58 90	.01 50	.35 -141
200	.87 173	7.97 81	.01 63	.31 -160
400	.86 165	3.96 69	.03 65	.30 -172
600	.86 160	2.62 58	.05 60	.31 -175
800	.84 154	1.96 47	.07 58	.32 -176
1000	.85 149	1.58 38	.09 57	.34 -177
1200	.85 144	1.33 30	.10 55	.36 -178
1400	.85 140	1.16 22	.12 53	.38 -180
1600	.86 135	1.01 14	.14 49	.42 179
1800	.87 131	.90 8	.15 47	.44 177
2000	.87 126	.83 1	.17 42	.47 175