NEC®

NPN SILICON HIGH FREQUENCY TRANSISTOR

NE56700 NE56708 NE56787

FEATURES

- HIGH GAIN BANDWIDTH PRODUCT
- IDEAL FOR LINEAR CLASS A AMPLIFIERS

DESCRIPTION AND APPLICATIONS

The NE567 Series of NPN Silicon Bipolar Transistors is designed for general purpose and ultra linear small signal amplifier applications up to 4 GHz and oscillator applications up into X-Band. The NE567 is available in a variety of packages and in chip form.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	25
V_{CEO}	Collector to Emitter Voltage	V	12
V_{EBO}	Emitter to Base Voltage	V	2
I_C	Collector Current	mA	60
T_J	Junction Temperature	°C	200
T_{STG}	Storage Temperature	°C	-65 to +200

PERFORMANCE SPECIFICATIONS (T_A = 25°C)

PART NUMBER EIAJ[1] REGISTERED NUMBER PACKAGE OUTLINE			NE56700 CHIP			NE56708 2SC2338 08			NE56787 87		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f_S	Frequency where $\|S_{21}\|^2$ = 0 dB	GHz	7.5	8		7.5	8		7.5	8	
I_{CBO}	Collector Cutoff Current at V_{CB} = 10 V, I_E = 0	µA			1			1			1
I_{EBO}	Emitter Cutoff Current at V_{EB} = 1 V, I_C = 0	µA			1			1			1
h_{FE}	Forward Current Gain[2] at V_{CE} = 10 V, I_C = 30 mA		30	100	200	30	100	200	30	100	200
C_{OB}	Output Capacitance[3] at V_{CB} = 10 V, I_E = 0, f = 1 MHz	pF		0.44	0.80		0.44	0.80		0.44	0.80
$\|S_{21E}\|^2$	Insertion Gain at V_{CE} = 10 V, I_C = 30 mA, f = 4 GHz	dB	5.5	6		5.5	6				
MAG	Maximum Available Gain[4] at V_{CE} = 10 V, I_C = 30 mA, f = 4 GHz	dB		11			10.5				
R_{TH}	Thermal Resistance[5] (Junction-to-Case)	°C/W			40			50			40
P_T	Total Power Dissipation	W			0.6			0.6			0.6

Notes:

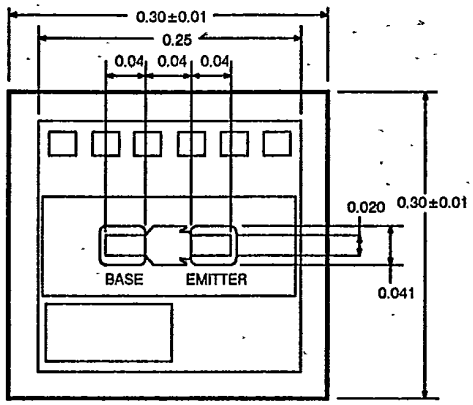
1. Electronic Industrial Association of Japan.
2. PW ≤ 350 µs, duty cycle ≤ 2%/pulsed.
3. Emitter is grounded.
4. Maximum Available Gain (MAG) is calculated from the device S-Parameters using the equation,

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right) \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{21}|\,|S_{12}|} \quad \Delta = S_{11}S_{22} - S_{21}S_{12}$$

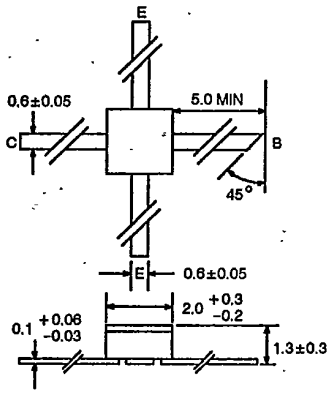
5. R_{TH} (Junction-to-Ambient) for the NE56708 is 420°C/W.

OUTLINE DIMENSIONS (Units in mm)

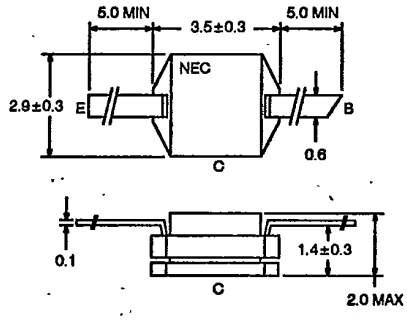
NE56700 (CHIP)
(Chip Thickness: .110 to .160 µm)



OUTLINE 08



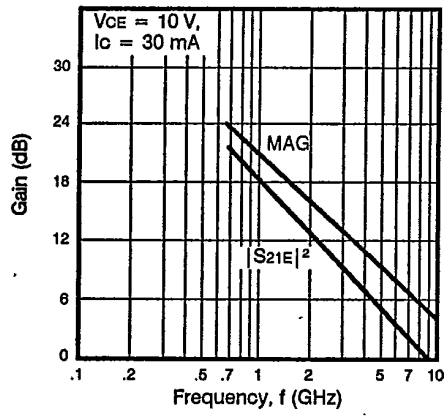
OUTLINE 87



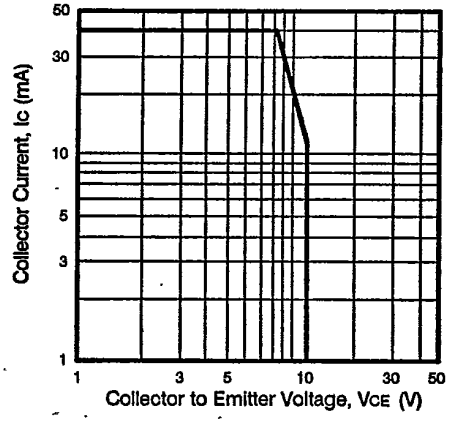
*All dimensions typical unless noted.

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C)

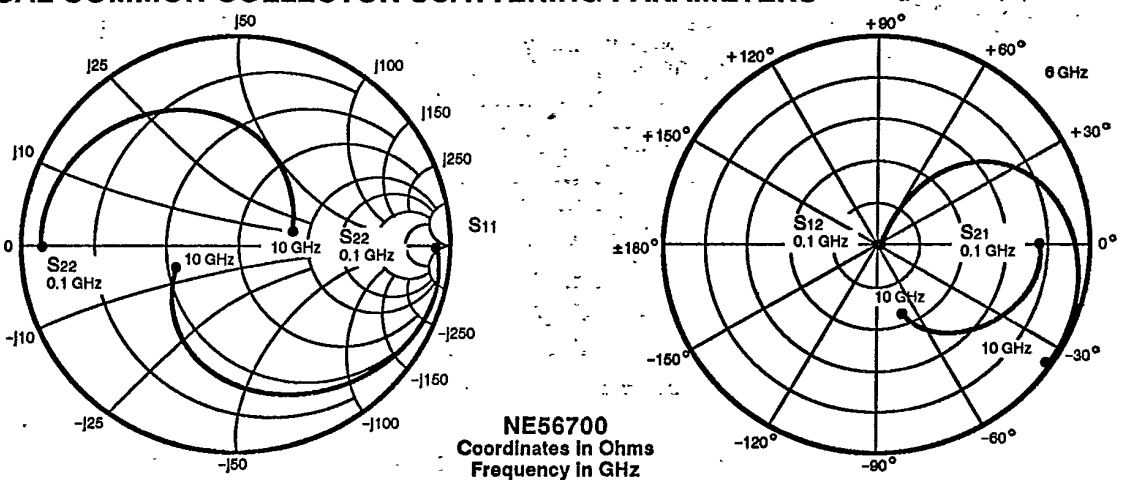
NE56708
INSERTION GAIN AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY



NE567 SERIES
SAFE OPERATING AREA



TYPICAL COMMON COLLECTOR SCATTERING PARAMETERS



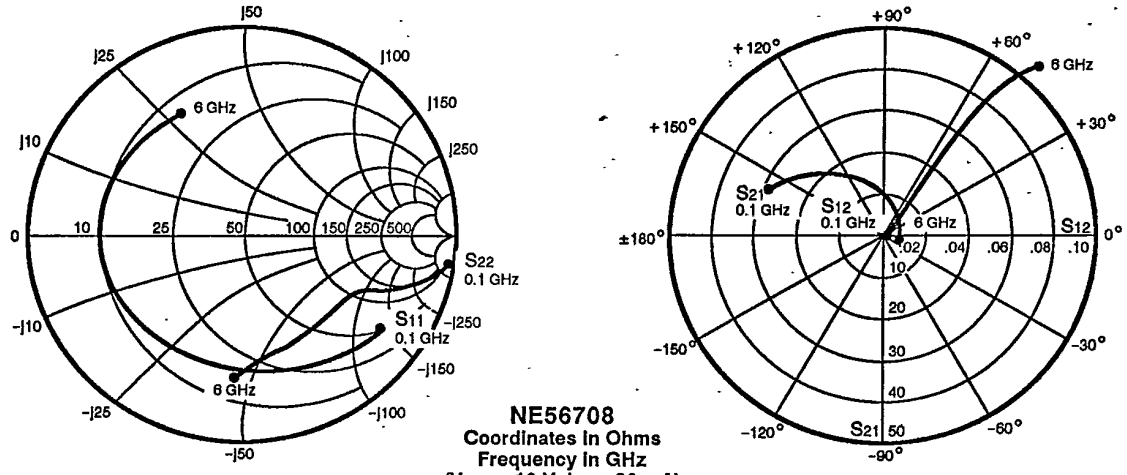
NE56700
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 9.5 V, I_C = 24 mA)

S-MAGN AND ANGLES:

V_{CE} = 9.5 V, I_C = 24 mA

FREQUENCY (GHz)	S_{11}		S_{21}		S_{12}		S_{22}	
0.10	0.97	0.60	1.86	-0.80	0.05	34.20	0.89	178.00
0.50	0.96	-9.0	1.89	-6.40	0.12	65.40	0.89	170.00
1.00	0.95	-18.20	1.87	-13.20	0.23	65.40	0.88	160.00
1.50	0.93	-28.00	1.83	-18.95	0.32	59.60	0.85	150.90
2.00	0.91	-38.00	1.78	-24.45	0.42	53.60	0.82	141.90
2.50	0.88	-46.20	1.72	-28.60	0.50	48.50	0.79	134.25
3.00	0.84	-54.20	1.66	-32.60	0.58	43.50	0.75	126.75
3.50	0.81	-62.20	1.60	-37.20	0.64	37.60	0.72	118.80
4.00	0.78	-70.20	1.53	-41.60	0.70	31.60	0.67	110.80
4.50	0.74	-77.40	1.45	-45.60	0.75	26.60	0.65	103.80
5.00	0.70	-84.30	1.39	-49.60	0.79	20.60	0.61	96.70
5.50	0.67	-90.40	1.32	-52.70	0.83	15.95	0.59	90.60
6.00	0.64	-96.40	1.26	-55.70	0.86	11.45	0.56	84.60
6.50	0.60	-103.30	1.21	-58.70	0.89	6.50	0.52	78.60
7.00	0.57	-107.60	1.15	-59.00	0.91	3.30	0.50	73.50
7.50	0.54	-113.40	1.11	-61.25	0.93	-1.05	0.47	68.05
8.00	0.51	-119.40	1.06	-63.75	0.95	-5.55	0.45	62.55
8.50	0.48	-124.05	1.02	-65.35	0.96	-9.60	0.43	57.05
9.00	0.44	-128.55	0.97	-66.85	0.98	-13.60	0.41	51.55
9.50	0.42	-133.50	0.94	-68.35	0.99	-17.60	0.39	45.60
10.00	0.40	-138.50	0.92	-69.85	0.99	-21.60	0.36	39.60

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE56708
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_C = 30 mA)

S-MAGN AND ANGLES:

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

FREQUENCY (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
100	.81	-25	18.47	163	.00	76	.98	-7
500	.70	-101	12.12	120	.02	47	.76	-23
1000	.65	-142	7.33	96	.03	36	.63	-32
1500	.64	-161	5.13	80	.03	32	.63	-36
2000	.62	-173	3.88	69	.04	40	.63	-42
2500	.63	174	3.16	58	.05	31	.59	-49
3000	.64	165	2.74	51	.05	42	.59	-59
3500	.64	157	2.31	41	.06	48	.62	-65
4000	.65	148	2.13	33	.06	48	.60	-72
4500	.65	143	1.83	18	.07	45	.63	-81
5000	.62	134	1.65	13	.07	43	.62	-85
5500	.63	130	1.55	4	.09	47	.68	-91
6000	.62	119	1.41	-1	.10	45	.71	-96

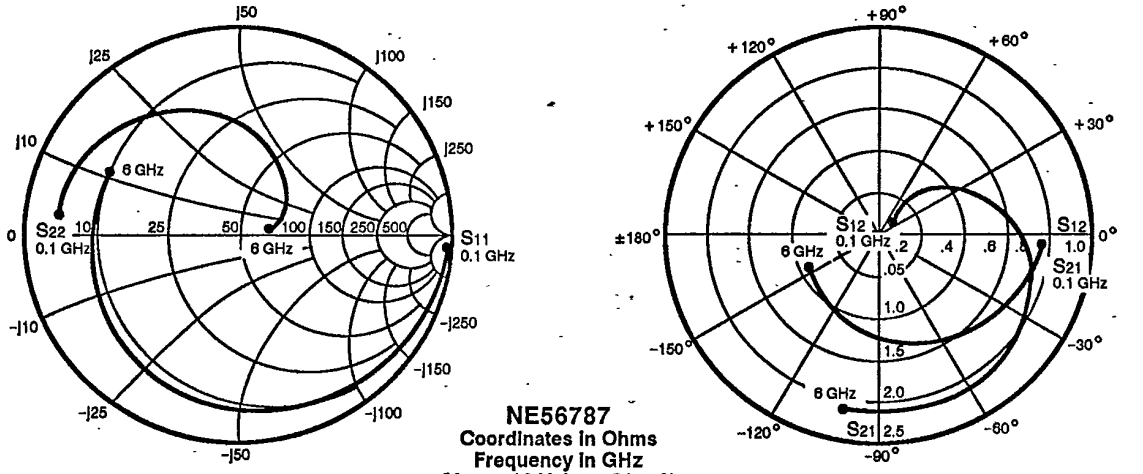
V_{CE} = 10 V, I_C = 20 mA

100	.77	-32	25.71	159	.00	77	.96	-9
500	.66	-115	14.56	113	.01	45	.69	-24
1000	.63	-151	8.32	92	.02	39	.58	-31
1500	.63	-167	5.77	78	.02	36	.58	-36
2000	.61	-178	4.33	68	.03	49	.59	-41
2500	.62	168	3.52	57	.05	45	.55	-48
3000	.63	160	3.06	50	.05	52	.55	-59
3500	.63	152	2.59	41	.06	52	.57	-64
4000	.65	144	2.36	31	.07	51	.56	-71
4500	.61	141	2.01	19	.07	47	.59	-80
5000	.62	132	1.84	12	.08	45	.62	-84
5500	.63	127	1.70	4	.09	48	.63	-93
6000	.62	117	1.54	-1	.10	47	.67	-95

V_{CE} = 10 V, I_C = 30 mA

100	.75	-36	29.82	157	.00	71	.96	-10
500	.65	-123	15.33	110	.01	45	.66	-23
1000	.63	-157	8.51	90	.01	43	.56	-30
1500	.63	-172	5.86	76	.02	43	.57	-35
2000	.61	178	4.40	67	.03	53	.58	-40
2500	.64	166	3.58	56	.05	51	.55	-47
3000	.64	159	3.10	49	.05	50	.55	-58
3500	.63	152	2.59	40	.06	55	.57	-63
4000	.65	143	2.39	31	.07	55	.57	-70
4500	.63	139	2.05	17	.08	50	.59	-80
5000	.62	131	1.88	13	.08	49	.57	-83
5500	.62	126	1.72	3	.10	51	.65	-90
6000	.62	116	1.58	-1	.11	47	.68	-95

TYPICAL COMMON COLLECTOR SCATTERING PARAMETERS



NE56787
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_C = 30 mA)

S-MAGN AND ANGLES:

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

FREQUENCY (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
100	.94	-6	1.76	-7	.09	52	.79	170
500	.90	-35	1.66	-24	.33	52	.73	147
1000	.84	-62	1.49	-38	.57	28	.60	121
1500	.74	-89	1.33	-52	.68	8	.46	104
2000	.67	-109	1.20	-66	.77	-9	.36	88
2500	.62	-135	1.14	-72	.84	-19	.30	81
3000	.58	-153	1.07	-83	.88	-34	.23	67
3500	.56	-170	1.00	-91	.90	-46	.16	53
4000	.57	173	.97	-100	.92	-59	.11	53
4500	.56	157	.91	-111	.93	-72	.08	57
5000	.55	140	.88	-120	.94	-85	.05	64
5500	.54	127	.83	-133	.92	-99	.03	123
6000	.55	116	.78	-142	.90	-112	.09	143

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

100	.94	-5	1.80	-7	.06	44	.83	172
500	.93	-30	1.74	-21	.24	56	.80	154
1000	.92	-53	1.64	-35	.43	38	.71	134
1500	.85	-79	1.51	-50	.55	19	.61	118
2000	.80	-100	1.40	-65	.66	2	.53	102
2500	.74	-116	1.29	-75	.72	-10	.48	90
3000	.70	-133	1.20	-87	.78	-25	.42	77
3500	.68	-148	1.12	-97	.81	-37	.35	63
4000	.67	-164	1.06	-107	.85	-52	.29	57
4500	.64	-178	.99	-118	.88	-65	.26	49
5000	.62	166	.95	-129	.90	-79	.23	41
5500	.61	154	.90	-141	.90	-93	.18	34
6000	.62	141	.82	-152	.89	-106	.13	43

V_{CE} = 10 V, I_C = 30 mA

100	.94	-5	1.81	-6	.05	42	.85	173
500	.94	-27	1.78	-20	.20	56	.83	157
1000	.94	-50	1.68	-33	.37	41	.75	139
1500	.89	-75	1.58	-48	.49	24	.67	123
2000	.85	-96	1.49	-64	.59	8	.60	109
2500	.80	-108	1.35	-76	.68	-5	.55	98
3000	.76	-123	1.25	-88	.75	-21	.48	83
3500	.75	-137	1.17	-98	.79	-34	.40	67
4000	.73	-152	1.12	-108	.82	-49	.32	57
4500	.70	-166	1.04	-121	.84	-62	.28	45
5000	.68	-180	1.00	-131	.84	-76	.23	31
5500	.67	167	.95	-145	.84	-91	.17	18
6000	.67	154	.87	-156	.83	-104	.09	14