NEC

SUPER LOW NOISE PSEUDOMORPHIC HJ FET

NE42484A

FEATURES

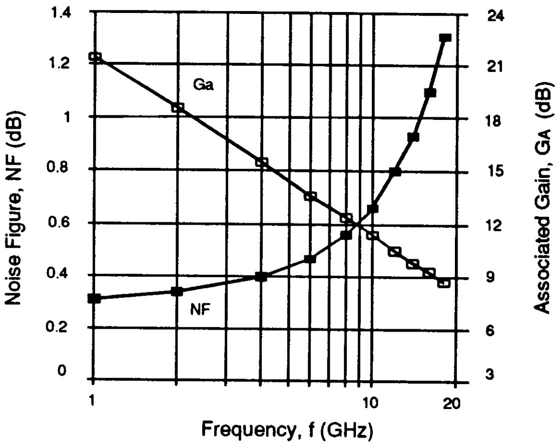
- **VERY LOW NOISE FIGURE:** 0.8 dB typical at 12 GHz
- **HIGH ASSOCIATED GAIN:** 10.5 dB Typical at 12 GHz
- **L_G = 0.35 μm, W_G = 200 μm**
- **LOW COST METAL CERAMIC PACKAGE**
- **TAPE & REEL PACKAGING OPTION AVAILABLE**

DESCRIPTION

The NE42484A is a pseudomorphic Hetero-Junction FET that uses the junction between Si-doped AlGaAs and undoped InGaAs to create very high mobility electrons. The device features mushroom shaped TiAl gates for decreased gate resistance and improved power handling capabilities. The mushroom gate also results in lower noise figure and high associated gain. This device is housed in an epoxy-sealed, metal/ceramic package and is intended for high volume consumer and industrial applications.

NEC's stringent quality assurance and test procedures assure the highest reliability and performance.

NOISE FIGURE & ASSOCIATED GAIN vs. FREQUENCY
V_{DS} = 2 V, I_{DS} = 10 mA



ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE42484A 84AS		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
NF_{OPT}[1]	Optimum Noise Figure, V_{DS} = 2.0 V, I_{DS} = 10 mA, f = 12 GHz	dB		0.8	1.2
G_A[1]	Associated Gain, V_{DS} = 2.0 V, I_{DS} = 10 mA, f = 12 GHz	dB	9.0	10.5	
P_{1dB}	Output Power at 1 dB Gain Compression Point, f = 12 GHz V_{DS} = 2.0 V, I_{DS} = 10 mA V_{DS} = 2.0 V, I_{DS} = 20 mA	dBm dBm		9.7 10.2	
G_{1dB}	Gain at P_{1dB}, f = 12 GHz V_{DS} = 2.0 V, I_{DS} = 10 mA V_{DS} = 2.0 V, I_{DS} = 20 mA	dB dB		10.3 10.5	
I_{DSS}	Saturated Drain Current, V_{DS} = 2.0 V, V_{GS} = 0 V	mA	15	40	70
V_P	Pinch-off Voltage, V_{DS} = 2.0 V, I_{DS} = 0.1 mA	V	-2.0	-0.8	-0.2
g_m	Transconductance, V_{DS} = 2.0 V, I_D = 10 mA	mS	45	60	
I_{GSO}	Gate to Source Leakage Current, V_{GS} = -3.0 V	μA		0.5	10.0
$R_{TH (CH-A)}$	Thermal Resistance (Channel to Ambient)	°C/W		750	
$R_{TH(CH-C)}$[2]	Thermal Resistance (Channel to Case)	°C/W			350

Notes:
1. Typical values of noise figures and associated gain are those obtained when 50% of the devices from a large number of lots were individually measured in a circuit with the input individually tuned to obtain the minimum value. Maximum values are criteria established on the production line as a "go-no-go" screening tuned for the "generic" type but not specimen.
2. R_{TH} (channel to case) for package mounted on an infinite heat sink.

ABSOLUTE MAXIMUM RATINGS[1] ($T_A = 25°C$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	4.0
V_{GS}	Gate to Source Voltage	V	-3.0
I_{DS}	Drain Current	mA	I_{DSS}
I_{GRF}	Gate Current (RF Drive)	μA	200
P_{IN}	RF Input (CW)	dBm	15
T_{CH}	Channel Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150
P_T	Total Power Dissipation	mW	165

Note:
1. Operation in excess of any one of these parameters may result in permanent damage.

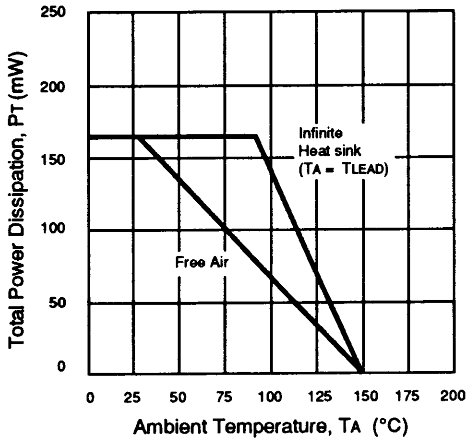
TYPICAL NOISE PARAMETERS ($T_A = 25°C$)

$V_{DS} = 2$ V, $I_{DS} = 10$ mA

FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
1.0	0.31	21.4	0.78	10	0.43
2.0	0.34	18.5	0.76	28	0.38
4.0	0.40	15.5	0.72	58	0.28
6.0	0.47	13.6	0.65	84	0.21
8.0	0.56	12.4	0.57	113	0.15
10.0	0.66	11.4	0.50	141	0.10
12.0	0.80	10.5	0.44	173	0.09
14.0	0.93	9.8	0.39	-157	0.08
16.0	1.10	9.3	0.36	-125	0.08
18.0	1.31	8.7	0.35	-90	0.08

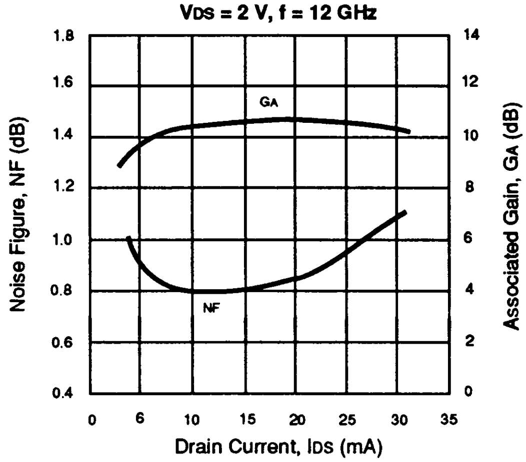
TYPICAL PERFORMANCE CURVES ($T_A = 25°C$)

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE[1]

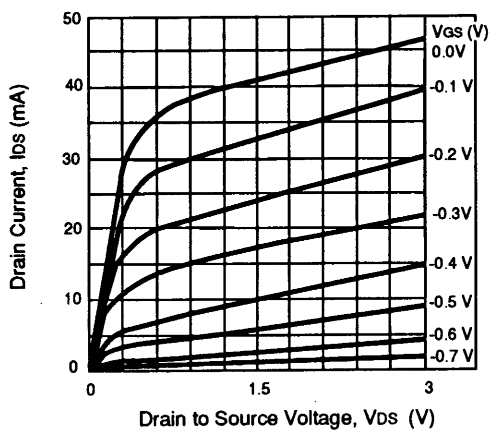


Note
1. If P_T exceeds the Free Air Value, reliable operation can be assured by measuring the worst-case temperature, $T_{(LEAD)}$, at the lead where heat flow is maximum (usually the source lead) and limiting T_A, P_T or $R_{TH\,(CKT)}$

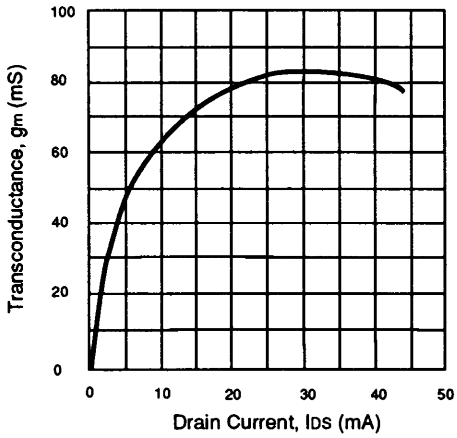
NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT
$V_{DS} = 2$ V, f = 12 GHz



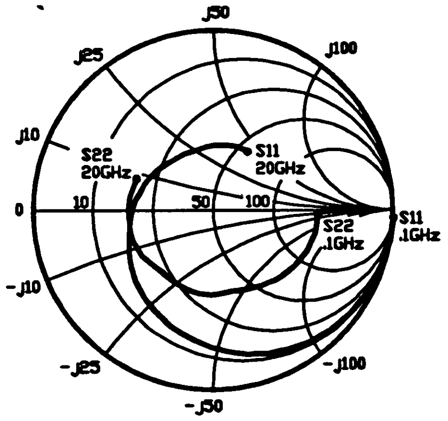
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

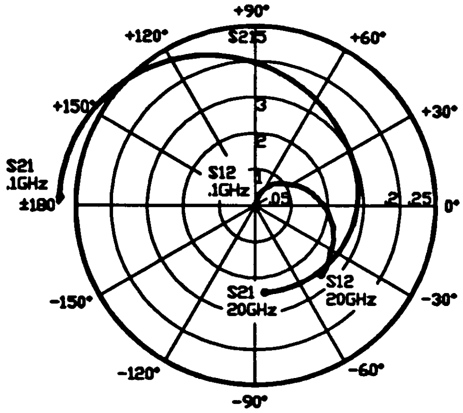


TRANSCONDUCTANCE vs. DRAIN CURRENT
$V_{DS} = 2.0$ V



TYPICAL COMMON SOURCE SCATTERING PARAMETERS ($T_A = 25°C$)





$V_{DS} = 2$ V, $I_{DS} = 10$ mA

FREQ	S_{11}		S_{21}		S_{12}		S_{22}		K	S_{21}	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)	(dB)
0.1	0.999	-1.9	5.116	178.3	0.002	87.2	0.673	-1.3	0.07	14.2	33.4
0.2	0.998	-3.9	5.115	176.2	0.004	85.5	0.672	-2.7	0.08	14.2	30.5
0.5	0.994	-9.8	5.101	170.0	0.011	81.6	0.667	-6.7	0.11	14.2	26.7
1.0	0.981	-19.7	5.047	160.1	0.021	75.7	0.657	-13.2	0.16	14.1	23.8
2.0	0.944	-39.1	4.853	141.4	0.037	63.7	0.634	-26.1	0.27	13.7	21.1
3.0	0.900	-57.5	4.594	124.0	0.050	52.4	0.604	-38.7	0.35	13.2	19.6
4.0	0.852	-74.5	1.314	107.7	0.061	42.2	0.571	-51.0	0.44	12.7	18.4
5.0	0.801	-89.9	4.044	92.3	0.070	33.4	0.536	-63.0	0.53	12.1	17.6
6.0	0.750	-104.1	3.798	77.5	0.077	25.5	0.499	-75.0	0.63	11.6	16.9
7.0	0.698	-117.2	3.584	63.2	0.084	18.4	0.462	-87.0	0.73	11.1	16.3
8.0	0.648	-129.8	3.403	49.2	0.090	11.7	0.428	-99.4	0.84	10.6	15.7
9.0	0.598	-142.4	3.251	35.4	0.095	5.2	0.399	-112.7	0.92	10.2	15.3
10.0	0.551	-155.4	3.121	21.7	0.100	-1.3	0.378	-127.5	0.99	9.9	14.9
11.0	0.508	-169.5	3.008	7.9	0.106	-7.9	0.367	-144.2	1.04	9.6	13.3
12.0	0.469	174.9	2.902	-6.0	0.111	-14.9	0.369	-163.3	1.06	9.3	12.2
13.0	0.435	157.6	2.796	-20.3	0.116	-22.3	0.385	175.5	1.06	8.9	12.2
14.0	0.407	138.6	2.682	-34.9	0.121	-30.3	0.413	154.6	1.06	8.6	11.9
15.0	0.386	118.1	2.552	-50.1	0.125	-38.9	0.452	134.2	1.06	8.1	11.6
16.0	0.373	96.5	2.404	-65.7	0.127	-48.3	0.500	115.8	1.05	7.6	11.3
17.0	0.370	74.9	2.234	81.9	0.129	-58.5	0.553	99.7	1.04	7.0	11.1
18.0	0.376	54.4	2.045	-98.1	0.128	-69.7	0.612	85.5	1.02	6.2	11.2
19.0	0.394	37.1	1.840	-113.3	0.124	-82.0	0.673	73.0	0.98	5.3	11.7
20.0	0.424	25.1	1.627	-124.3	0.116	-95.3	0.737	61.5	0.90	4.2	11.4

Note:
1. Gain Calculations:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

TYPICAL COMMON SOURCE SCATTERING PARAMETERS (T_A = 25°C)

V_{DS} = 2 V, I_{DS} = 20 mA

FREQ	S11		S21		S12		S22		K	S21	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)	(dB)
0.1	0.999	-2.1	6.220	177.9	0.002	88.6	0.597	-1.3	0.06	15.9	34.9
0.2	0.998	-4.2	6.213	175.7	0.004	87.2	0.597	-2.6	0.07	15.9	32.0
0.5	0.992	-10.5	6.177	169.4	0.009	83.1	0.594	-6.6	0.12	15.8	28.1
1.0	0.976	-21.0	6.077	159.2	0.018	76.6	0.585	-13.0	0.20	15.7	25.2
2.0	0.931	-41.2	5.769	139.8	0.033	64.8	0.562	-25.6	0.32	15.2	22.4
3.0	0.879	-60.2	5.385	121.8	0.045	54.5	0.534	-37.7	0.42	14.6	20.7
4.0	0.824	-77.4	4.988	105.0	0.055	45.5	0.503	-49.4	0.52	14.0	19.5
5.0	0.768	-92.9	4.614	89.4	0.064	37.7	0.469	-60.7	0.62	13.3	18.5
6.0	0.712	-107.0	4.283	74.8	0.072	30.7	0.435	-71.9	0.73	12.6	17.5
7.0	0.658	-120.1	4.000	60.9	0.079	24.3	0.402	-83.1	0.82	12.0	17.0
8.0	0.606	-132.6	3.766	47.4	0.086	18.3	0.371	-94.7	0.91	11.5	16.3
9.0	0.557	-145.1	3.573	34.2	0.094	12.3	0.345	-107.4	0.98	11.1	15.8
10.0	0.511	-158.3	3.414	21.1	0.101	6.1	0.328	-121.7	1.03	10.7	14.2
11.0	0.470	-172.6	3.278	7.8	0.108	-0.5	0.320	-138.5	1.05	10.3	13.4
12.0	0.433	171.4	3.156	-5.9	0.115	-7.8	0.325	-157.8	1.06	10.0	12.9
13.0	0.402	153.6	3.038	-20.0	0.122	-15.9	0.343	-179.1	1.04	9.7	12.6
14.0	0.378	133.9	2.913	-34.7	0.219	-24.9	0.374	159.0	1.03	9.3	12.4
15.0	0.361	112.7	2.775	-49.8	0.134	-34.8	0.415	138.1	1.02	8.9	12.3
16.0	0.352	90.4	2.618	-65.2	0.139	-45.5	0.465	119.1	1.00	8.4	12.4
17.0	0.352	68.2	2.441	-80.8	0.140	-56.8	0.520	102.6	0.99	7.8	12.4
18.0	0.361	47.6	2.244	-96.1	0.140	-68.3	0.578	88.1	0.98	7.0	12.0
19.0	0.381	30.6	2.032	-110.6	0.135	-79.7	0.636	75.3	0.96	6.2	11.7
20.0	0.413	19.7	1.813	-123.8	0.126	-90.4	0.693	63.9	0.93	5.2	11.5

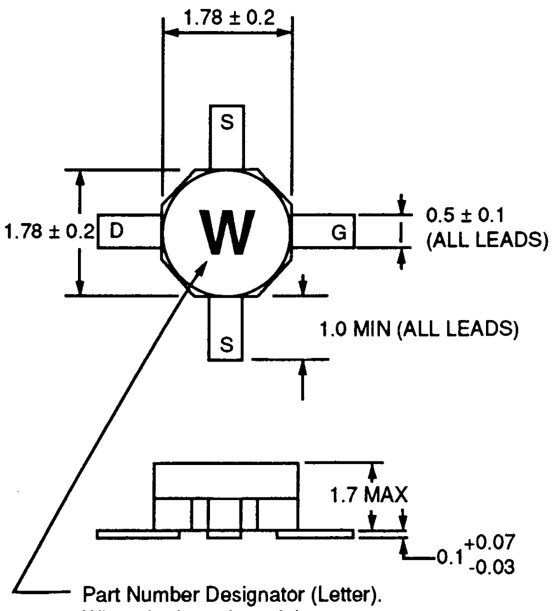
Note:
1. Gain Calculations:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

OUTLINE 84AS



Part Number Designator (Letter).
When the letter is upright,
the gate lead is to the right.

ORDERING INFORMATION[1]

PART NUMBER	AVAILABILITY	PACKAGE
NE42484AS	Bulk up to 1 K	84AS
NE42484A-T1	1K/Reel	84AS

Note:
Not available in long lead, 84A package.

NEC

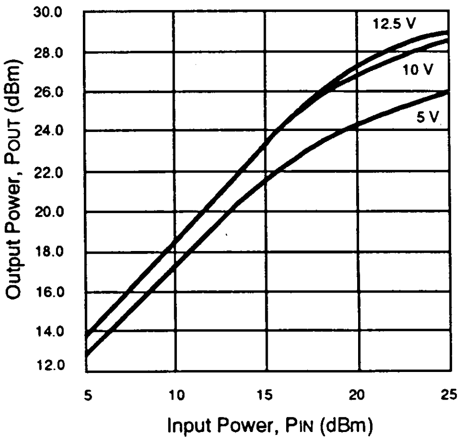
NPN MEDIUM POWER MICROWAVE TRANSISTOR

NE46100 NE46134

FEATURES

- HIGH DYNAMIC RANGE
- LOW IM DISTORTION: -40 dBc
- HIGH OUTPUT POWER : 27.5 dBm at TYP
- LOW NOISE: 1.5 dB TYP at 500 MHz
- LOW COST
- AVAILABLE IN TAPE & REEL OR BULK

NE46134 TYPICAL OUTPUT POWER vs. INPUT POWER f = 1.0 GHz, Ic = 100 mA



DESCRIPTION

The NE461 series of NPN silicon epitaxial bipolar transistors is designed for medium power applications requiring high dynamic range. This device exhibits an outstanding combination of high gain and low intermodulation distortion, as well as low noise figure. The NE461 series offers excellent performance and reliability at low cost through NEC's titanium, platinum, gold metalization system and direct nitride passivation of the surface of the chip. Devices are available in a low cost surface mount package (SOT-89) as well as in chip form.

3

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER / PACKAGE CODE			NE46100 00 (CHIP)			NE46134 34		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
f_T	Gain Bandwidth Product at V_{CE} = 10 V, I_C = 100 mA	GHz		5.5			5.5	
NF	Minimum Noise Figure[2] at V_{CE} = 10 V, I_C = 50 mA, 500 MHz	dB		1.5			1.5	
	V_{CE} = 10 V, I_C = 50 mA, 1 GHz	dB		2.0			2.0	
G_L	Linear Gain, V_{CE} = 12.5 V, I_C = 100 mA, 2.0 GHz	dB		9.0				
	V_{CE} = 12.5 V, I_C = 100 mA, 1.0 GHz	dB					8.0	
$\|S_{21E}\|^2$	Insertion Power Gain at 10 V, 50 mA, f = 1.0 GHz	dB		10.0		5.5	7.0	
h_{FE}	DC Current Gain at V_{CE} = 10 V, I_C = 50 mA		40		200	40		200
I_{CBO}	Collector Cutoff Current at V_{CB} = 20 V, I_E = 0 mA	µA			5.0			5.0
I_{EBO}	Emitter Cutoff Current at V_{EB} = 2 V, I_C = 0 mA	µA			5.0			5.0
P_{1dB}	Output Power at 1 dB Compression, V_{CE} = 12.5 V, I_C = 100 mA, 2.0 GHz	dBm	27.0					
	V_{CE} = 12.5 V, I_C = 100 mA, 1.0 GHz	dBm					27.5	
IM^3	Intermodulation Distortion, 10 V, 100 mA, F1 = 1.0 GHz, F2 = 0.99 GHz, Total P_{OUT} = 20 dBm	dBc	-40.0			-40.0		
$R_{TH\ (J-C)}$	Thermal Resistance (Junction to Case)	°C/W			30			32.5
$R_{TH\ (J-A)}$	Thermal Resistance (Junction to Ambient)	°C/W					312.5	

Notes:
1. Pulsed: PW ≤ 350 ms, Duty Cycle ≤ 2%
2. RS = RL = 50 Ω untuned

ABSOLUTE MAXIMUM RATINGS[1] ($T_A = 25°C$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	30
V_{CEO}	Collector to Emitter Voltage	V	15
V_{EBO}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	250
P_T	Total Power Dissipation NE46100[2] NE46134[3]	 W W	 3.75 2.0
T_J	Junction Temperature NE46100 NE46134	 °C °C	 200 150
T_{STG}	Storage Temperature NE46100 NE46134	 °C °C	 -65 to +200 -65 to +150

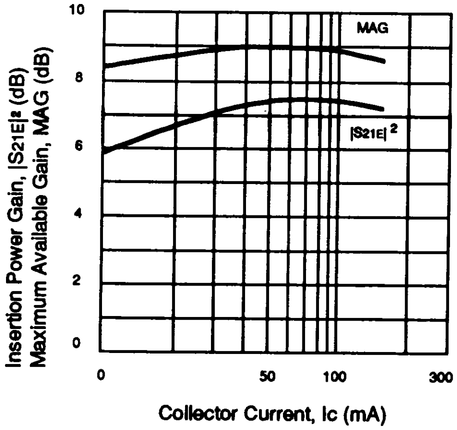
Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Chip mounted on an infinite heat sink (see AN-1001 for handling instructions).
3. Packaged device mounted on 0.7 mm x 2.5 cm² double sided ceramic substrate (copper plating).

NE46134
TYPICAL NOISE PARAMETERS ($T_A = 25°C$)

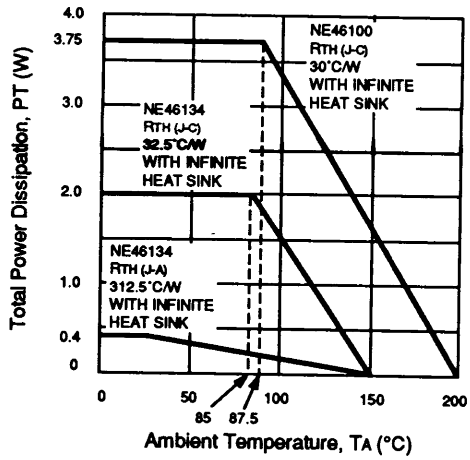
FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	RN/50
V_{CC} = 10 V, I_C = 50 mA					
0.5	1.5	13.5	0.34	-176	0.09

TYPICAL PERFORMANCE CURVES (T_A=25°C)

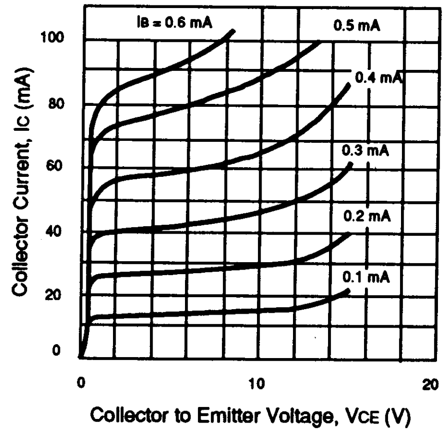
NE46134
INSERTION POWER GAIN AND MAXIMUM AVAILABLE GAIN vs. COLLECTOR CURRENT
V_{CE} = 10 V, f = 1 GHz



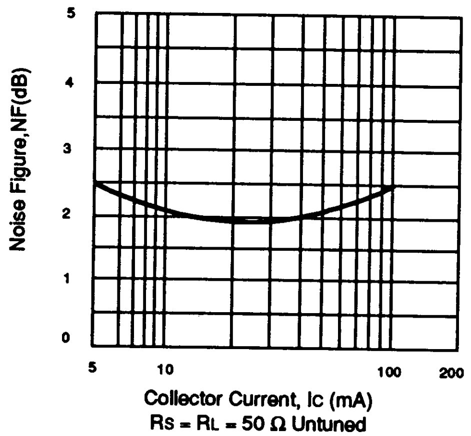
NE46100, NE46134
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



NE46100, NE46134
COLLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

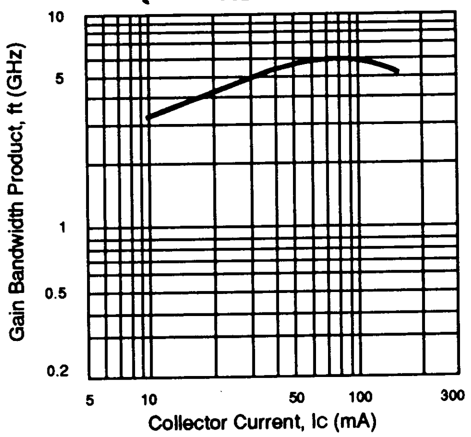


NE46100, NE46134
NOISE FIGURE vs. COLLECTOR CURRENT
V_{CE} = 10 V, f = 1 GHz

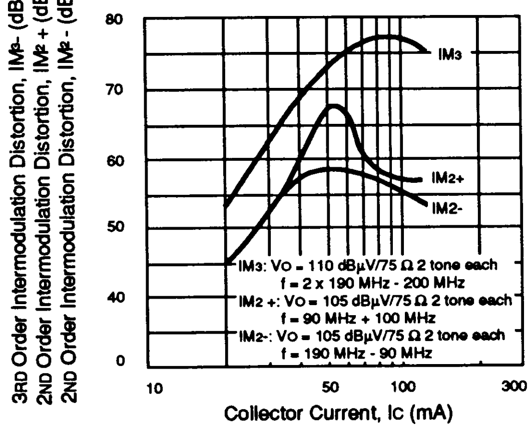


TYPICAL PERFORMANCE CURVES (TA = 25°C)

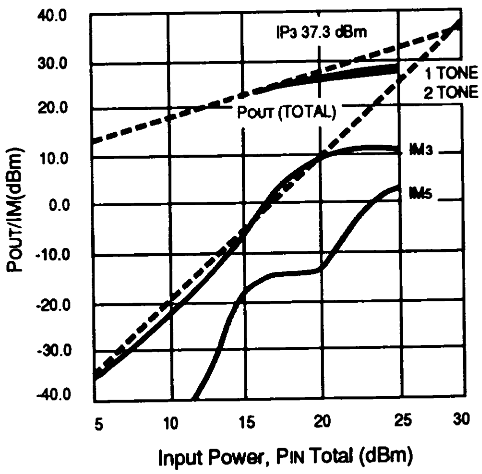
NE46100, NE46134
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT
VCE = 10 V



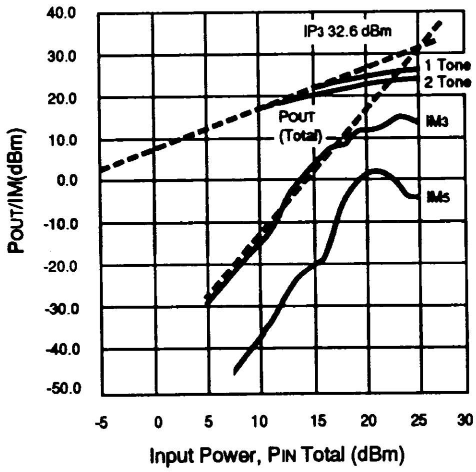
NE46134
3RD ORDER INTERMODULATION DISTORTION, 2ND ORDER INTERMODULATION DISTORTION (+ AND -) vs. COLLECTOR CURRENT



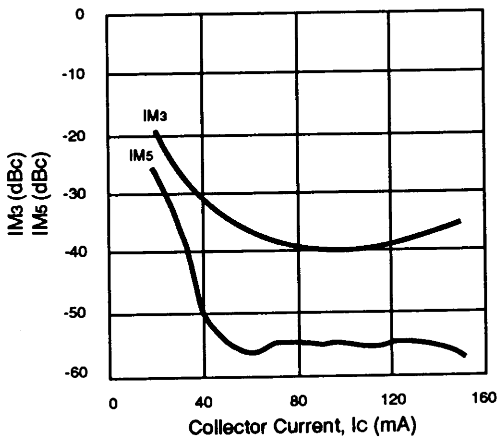
NE46134
TYPICAL OUTPUT POWER/INTERMODULATION DISTORTION vs. INPUT POWER
f = 1.0 GHz, VCE = 10 V, Ic = 100 mA
2 Tone Test F1 = 1.0 GHz, F2 = 0.99 GHz



NE46134
TYPICAL OUTPUT POWER/INTERMODULATION DISTORTION vs. INPUT POWER
f = 1.0 GHz, VCE = 5 V, Ic = 100 mA
2 Tone Test F1= 1.0 GHz, F2 = 0.99 GHz

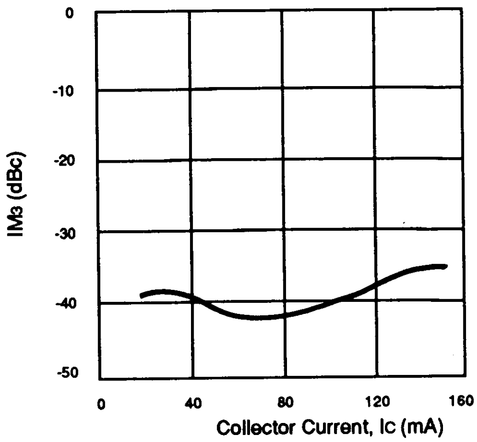


NE46100, NE46134
INTERMODULATION DISTORTION vs. COLLECTOR CURRENT
f = 1.0 GHz, VCE = 10 V



2 Tone Test
Total PIN = 12.1 dBm
F1 = 1.0 GHz, F2 = 0.99 GHz

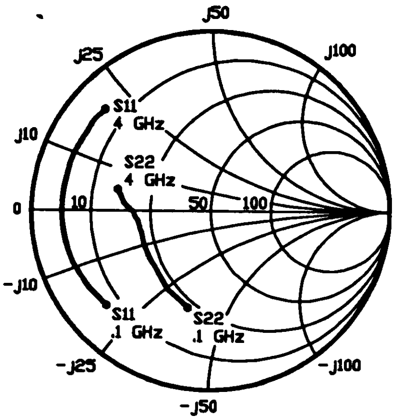
NE46100, NE46134
INTERMODULATION DISTORTION vs. COLLECTOR CURRENT
f = 1.0 GHz, VCE = 5 V

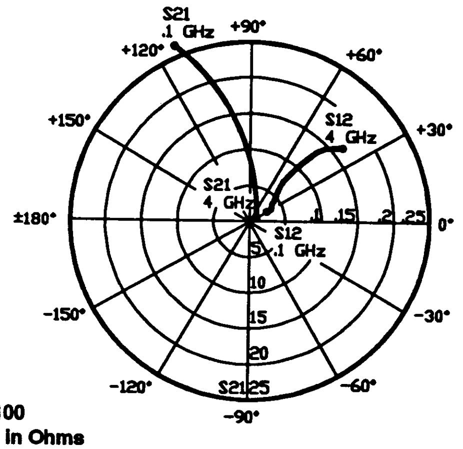


Total PIN = 6.0 dBm
F1 = 1.0 GHz, F2 = 0.99 GHz
Note: IM5 > than 58 dB down from carrier for measured currents greater than 40 mA.

3

TYPICAL COMMON EMITTER SCATTERING PARAMETERS[1] ($T_A = 25°C$)





NE46100
Coordinates in Ohms
Frequency in GHz
V_{CE} = 5 V, I_C = 50 mA

NE46100

V_{CE} = 5 V, I_C = 50 mA

FREQUENCY (MHz)	S_{11} MAG	S_{11} ANG	S_{21} MAG	S_{21} ANG	S_{12} MAG	S_{12} ANG	S_{22} MAG	S_{22} ANG	K	MAG[2] (dB)
100	0.778	-137	26.776	114	0.028	30	0.555	-102	0.16	29.8
200	0.815	-159	14.407	100	0.035	29	0.434	-135	0.36	26.2
500	0.826	-177	5.855	84	0.040	38	0.400	-162	0.75	21.7
800	0.827	176	3.682	76	0.052	43	0.402	-169	0.91	18.5
1000	0.826	173	2.963	71	0.058	47	0.405	-172	1.02	16.3
1200	0.825	170	2.441	66	0.064	47	0.412	-174	1.08	14.0
1400	0.820	167	2.111	61	0.069	47	0.413	-176	1.17	12.4
1600	0.828	165	1.863	57	0.078	54	0.426	-177	1.15	11.4
1800	0.827	162	1.671	53	0.087	50	0.432	-178	1.14	10.6
2000	0.828	159	1.484	49	0.093	50	0.431	-180	1.17	9.5
2500	0.822	153	1.218	39	0.11	48	0.462	177	1.18	7.8
3000	0.818	148	1.010	30	0.135	46	0.490	174	1.16	6.3
3500	0.824	142	0.876	21	0.147	44	0.507	170	1.16	5.3
4000	0.812	137	0.762	13	0.168	38	0.535	167	1.14	4.3

V_{CE} = 5 V, I_C = 100 mA

FREQUENCY (MHz)	S_{11} MAG	S_{11} ANG	S_{21} MAG	S_{21} ANG	S_{12} MAG	S_{12} ANG	S_{22} MAG	S_{22} ANG	K	MAG[2] (dB)
100	0.778	-144	27.669	111	0.027	35	0.523	-114	0.27	30.2
200	0.820	-164	14.559	97	0.029	29	0.445	-144	0.42	27.0
500	0.832	-179	5.885	84	0.035	38	0.435	-166	0.81	22.2
800	0.833	175	3.691	76	0.048	45	0.435	-173	0.95	18.8
1000	0.831	172	2.980	71	0.056	51	0.437	-176	1.05	16.0
1200	0.836	169	2.464	67	0.061	52	0.432	-178	1.11	14.0
1400	0.829	166	2.121	61	0.072	53	0.447	-180	1.12	12.6
1600	0.831	164	1.867	58	0.080	54	0.445	179	1.14	11.4
1800	0.827	161	1.671	54	0.090	53	0.460	178	1.14	10.4
2000	0.830	159	1.499	49	0.096	52	0.456	176	1.15	9.6
2500	0.831	153	1.228	40	0.115	51	0.479	173	1.15	8.0
3000	0.821	147	1.018	31	0.134	48	0.504	170	1.18	6.3
3500	0.820	142	0.881	23	0.155	42	0.516	167	1.14	5.3
4000	0.812	136	0.779	14	0.170	41	0.543	164	1.16	4.2

Notes:

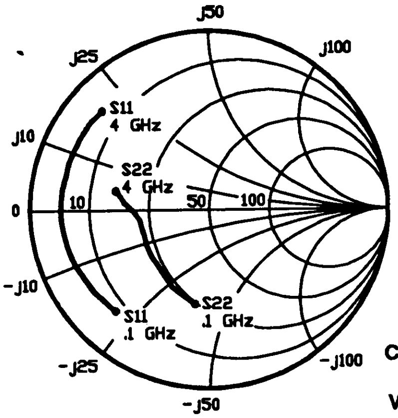
1. S-Parameters include Bond wires.
   - Base: Total 1 wire, 1 per Bond Pad, 0.0259" (658 μm) long each wire.
   - Collector: Total 1 wire, 1 per Bond Pad, 0.0182" (463 μm) long each wire.
   - Emitter: Total 2 wires, 1 per side, 0.0224" (569 μm) long each wire.
   - Wire: 0.0007" (17.8 μm) dia., gold.
2. Gain Calculations:

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

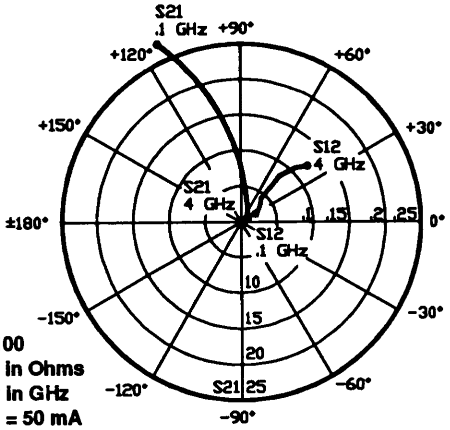
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL COMMON EMITTER SCATTERING PARAMETERS[1] ($T_A = 25°C$)



NE46100
Coordinates in Ohms
Frequency in GHz
V_{CE} = 8 V, I_C = 50 mA



NE46100
V_{CE} = 8 V, I_C = 50 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[2]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
100	0.773	-133	27.779	115	0.031	30	0.538	-99	0.20	29.5
200	0.808	-157	15.007	100	0.033	30	0.428	-132	0.36	26.6
500	0.824	-176	6.118	85	0.041	35	0.388	-160	0.70	21.8
800	0.823	177	3.841	76	0.050	42	0.388	-168	0.91	18.8
1000	0.822	173	3.095	71	0.060	50	0.388	-171	0.99	17.2
1200	0.824	170	2.570	67	0.065	48	0.389	-173	1.05	14.6
1400	0.820	167	2.201	61	0.075	46	0.395	-175	1.06	13.2
1600	0.825	165	1.937	57	0.080	49	0.410	-176	1.09	12.0
1800	0.822	162	1.747	53	0.084	48	0.416	-177	1.15	10.9
2000	0.821	160	1.551	49	0.095	50	0.421	-179	1.15	9.8
2500	0.816	154	1.267	39	0.116	50	0.449	177	1.16	8.0
3000	0.817	148	1.051	30	0.128	45	0.474	175	1.17	6.7
3500	0.817	143	0.910	22	0.154	45	0.496	171	1.12	5.6
4000	0.807	137	0.800	13	0.169	40	0.527	168	1.13	4.6

V_{CE} = 8 V, I_C = 100 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[2]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
100	0.771	-141	28.901	111	0.025	27	0.507	-109	0.23	30.6
200	0.816	-162	15.323	98	0.028	23	0.434	-142	0.38	27.4
500	0.823	-177	6.183	84	0.038	36	0.417	-165	0.76	22.1
800	0.822	176	3.889	76	0.047	48	0.419	-172	1.01	18.7
1000	0.824	172	3.124	71	0.057	49	0.418	-175	1.02	16.5
1200	0.822	169	2.605	67	0.064	54	0.422	-177	1.09	14.2
1400	0.816	166	2.223	62	0.073	56	0.426	-178	1.15	12.5
1600	0.821	164	1.962	58	0.079	54	0.435	180	1.15	11.6
1800	0.823	161	1.751	54	0.088	54	0.443	179	1.14	10.7
2000	0.823	159	1.563	50	0.097	55	0.438	177	1.17	9.6
2500	0.816	153	1.292	40	0.117	51	0.462	174	1.16	8.0
3000	0.814	148	1.061	31	0.134	48	0.491	171	1.18	6.5
3500	0.820	142	0.927	23	0.154	45	0.501	168	1.12	5.7
4000	0.807	137	0.814	15	0.170	41	0.529	165	1.15	4.4

V_{CE} = 10 V, I_C = 50 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[2]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
100	0.780	-132	28.079	115	0.029	46	0.548	-99	0.21	29.8
200	0.809	-156	15.218	100	0.033	29	0.425	-131	0.34	26.7
500	0.819	-175	6.206	85	0.041	34	0.387	-159	0.70	21.8
800	0.817	177	3.888	76	0.048	42	0.386	-168	0.96	19.4
1000	0.821	174	3.136	71	0.060	48	0.385	-170	.97	17.2
1200	0.821	171	2.596	67	0.063	47	0.388	-173	1.07	14.5
1400	0.814	168	2.236	62	0.068	53	0.394	-174	1.19	12.6
1600	0.819	165	1.976	58	0.075	50	0.401	-176	1.17	11.7
1800	0.816	162	1.769	53	0.084	51	0.413	-178	1.17	10.7
2000	0.819	160	1.565	49	0.094	49	0.416	-179	1.15	9.8
2500	0.815	154	1.290	39	0.116	51	0.439	178	1.14	8.2
3000	0.814	148	1.072	30	0.128	46	0.468	175	1.18	6.7
3500	0.819	143	0.920	22	0.150	44	0.488	173	1.12	5.8
4000	0.806	137	0.803	13	0.168	40	0.519	168	1.14	4.5

See notes on previous page.

TYPICAL COMMON EMITTER SCATTERING PARAMETERS[1] (TA = 25°C)

NE46100

VCE = 10 V, IC = 100 mA

FREQUENCY (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG[2] (dB)
100	0.791	-139	29.278	112	0.027	30	0.508	-109	0.22	30.4
200	0.809	-161	15.503	98	0.027	32	0.433	-140	0.43	27.5
500	0.822	-177	6.280	84	0.037	43	0.414	-165	0.81	22.3
800	0.815	176	3.939	76	0.046	48	0.408	-171	1.02	18.5
1000	0.819	173	3.176	71	0.055	50	0.411	-174	1.05	16.2
1200	0.818	170	2.621	67	0.064	54	0.412	-176	1.11	14.1
1400	0.814	167	2.255	62	0.070	52	0.418	-178	1.16	12.7
1600	0.821	164	1.990	58	0.078	52	0.430	-180	1.14	11.8
1800	0.823	161	1.786	54	0.090	53	0.434	179	1.11	11.0
2000	0.819	159	1.585	50	0.097	52	0.429	177	1.15	9.8
2500	0.816	153	1.304	40	0.113	51	0.458	174	1.18	8.1
3000	0.812	148	1.085	31	0.139	47	0.484	171	1.13	6.7
3500	0.813	142	0.937	23	0.153	45	0.501	168	1.14	5.6
4000	0.802	137	0.824	15	0.168	42	0.520	165	1.18	4.3

VCE = 12.5 V, IC = 50 ma

FREQUENCY (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG[2] (dB)
100	0.759	-129	28.230	116	0.032	30	0.543	-96	0.21	29.5
200	0.806	-155	15.378	101	0.035	31	0.420	-130	0.35	26.4
500	0.815	-175	6.261	85	0.041	34	0.380	-159	0.71	21.9
800	0.813	178	3.926	76	0.052	44	0.379	-167	.91	18.8
1000	0.14	174	3.179	71	0.058	45	0.375	-171	1.00	17.1
1200	0.816	171	2.629	67	0.067	47	0.382	-172	1.03	14.8
1400	0.810	168	2.266	62	0.071	46	0.385	-174	1.12	12.9
1600	0.817	165	1.993	58	0.079	47	0.400	-175	1.11	12.0
1800	0.816	163	1.770	53	0.087	49	0.408	-176	1.13	10.9
2000	0.817	160	1.592	49	0.090	51	0.408	-178	1.20	9.8
2500	0.811	154	1.301	40	0.109	50	0.441	179	1.20	8.0
3000	0.809	149	1.084	30	0.131	46	0.459	176	1.17	6.7
3500	0.811	143	0.934	22	0.150	45	0.482	172	1.15	5.6
4000	0.803	137	0.816	13	0.166	42	0.514	169	1.17	4.4

VCE = 12.5 V, IC = 100 mA

FREQUENCY (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG[2] (dB)
100	0.785	-138	29.375	112	0.027	25	0.510	-109	0.21	30.4
200	0.804	-160	15.593	98	0.030	32	0.421	-140	0.43	27.1
500	0.814	-177	6.318	84	0.040	42	0.401	-164	0.78	22.0
800	0.809	176	3.951	76	0.048	48	0.398	-171	1.02	18.3
1000	0.815	173	3.193	71	0.057	52	0.400	-174	1.05	16.1
1200	0.813	170	2.656	67	0.060	53	0.403	-177	1.17	14.0
1400	0.811	167	2.264	62	0.073	51	0.411	-178	1.13	12.7
1600	0.818	164	1.997	58	0.076	55	0.416	-180	1.19	11.6
1800	0.814	162	1.797	54	0.090	54	0.421	180	1.14	10.7
2000	0.813	160	1.613	49	0.094	50	0.424	178	1.18	9.8
2500	0.805	154	1.316	40	0.113	52	0.442	175	1.22	7.9
3000	0.813	148	1.091	31	0.133	46	0.470	172	1.15	6.7
3500	0.807	142	0.948	23	0.156	45	0.481	169	1.15	5.5
4000	0.802	137	0.826	14	0.164	40	0.510	166	1.19	4.4

Notes:

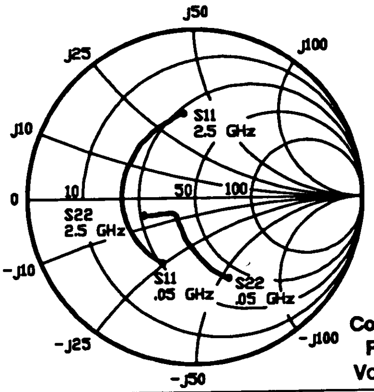
1. S-Parameters include Bond wires.
   - Base: Total 1 wire, 1 per Bond Pad, 0.0259" (658 μm) long each wire.
   - Collector: Total 1 wire, 1 per Bond Pad, 0.01 82 " (463 μm) long each wire.
   - Emitter: Total 2 wires, 1 per side, 0.0224" (569 μm) long each wire.
   - Wire: 0.0007" (17.8 μm) dia., gold.
2. Gain Calculations:

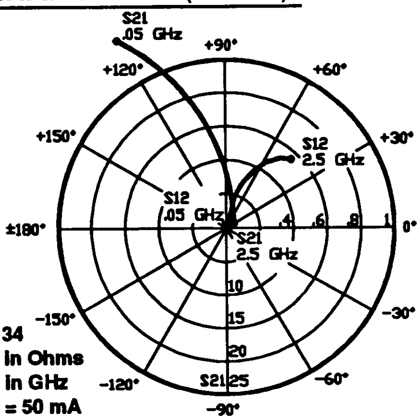
$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right).\ \text{When } K \leq 1,\ MAG = MSG.\quad MSG = \frac{|S_{21}|}{|S_{12}|},\ K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}S_{21}|},\ \Delta = S_{11}S_{22} - S_{21}S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (TA = 25°C)





NE46134
Coordinates in Ohms
Frequency in GHz
VCE = 5 V, Ic = 50 mA

NE46134
VCE = 5 V, Ic = 50 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[2]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
50	0.436	-117	32.710	120	0.026	60	0.520	-68	0.55	31.0
100	0.429	-148	18.264	104	0.037	65	0.310	-91	0.79	26.9
200	0.433	-169	9.472	92	0.059	70	0.197	-115	0.97	22.1
400	0.435	175	4.861	81	0.116	73	0.155	-133	1.01	15.7
600	0.436	165	3.318	74	0.170	74	0.153	-141	1.02	12.0
800	0.439	158	2.575	67	0.226	72	0.161	-146	1.01	10.0
1000	0.435	150	2.145	61	0.269	70	0.168	-148	1.02	8.2
1200	0.441	143	1.851	55	0.319	67	0.185	-151	1.01	7.1
1400	0.450	136	1.656	51	0.368	64	0.197	-152	0.99	6.5
1600	0.451	129	1.517	46	0.408	61	0.215	-155	0.99	5.7
1800	0.460	123	1.411	42	0.451	58	0.232	-157	0.98	5.0
2000	0.467	115	1.324	37	0.485	55	0.254	-157	0.97	4.4
2200	0.476	108	1.255	33	0.519	52	0.281	-159	0.97	3.8
2400	0.498	101	1.194	29	0.546	48	0.310	-161	0.96	3.4
2500	0.500	98	1.163	28	0.557	46	0.327	-161	0.96	3.2

VCE = 5 V, Ic = 100 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[2]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
50	0.425	-131	33.735	115	0.022	68	0.446	-77	0.65	31.9
100	0.439	-157	18.257	101	0.034	71	0.272	-103	0.87	27.3
200	0.437	-173	9.367	91	0.064	75	0.186	-128	0.97	21.7
400	0.442	173	4.787	81	0.121	77	0.164	-145	1.01	15.3
600	0.446	164	3.266	73	0.175	75	0.166	-152	1.02	11.0
800	0.445	156	2.537	67	0.229	73	0.176	-155	1.02	9.6
1000	0.451	148	2.108	61	0.276	69	0.184	-159	1.02	8.1
1200	0.449	142	1.831	56	0.327	67	0.189	-159	1.01	7.0
1400	0.454	135	1.650	50	0.372	63	0.208	-160	1.00	6.5
1600	0.458	129	1.515	46	0.415	60	0.221	-162	0.99	5.6
1800	0.465	122	1.397	41	0.456	57	0.238	-163	0.98	4.9
2000	0.470	115	1.316	37	0.489	54	0.255	-163	0.98	4.3
2200	0.483	108	1.249	33	0.523	50	0.284	-164	0.97	3.8
2400	0.499	100	1.184	29	0.548	47	0.307	-166	0.97	3.3
2500	0.503	97	1.166	27	0.562	45	0.325	-167	0.97	3.2

VCE = 8 V, Ic = 50 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[2]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
50	0.447	-110	33.339	121	0.024	60	0.534	-64	0.52	31.4
100	0.426	-143	18.770	104	0.039	69	0.317	-86	0.77	26.9
200	0.415	-166	9.754	93	0.060	72	0.189	-106	0.95	22.1
400	0.417	177	5.004	82	0.113	74	0.141	-124	1.01	15.8
600	0.417	167	3.423	74	0.167	74	0.138	-132	1.02	12.3
800	0.420	158	2.649	68	0.216	73	0.145	-138	1.02	10.0
1000	0.421	150	2.203	62	0.266	71	0.152	-140	1.01	8.5
1200	0.430	144	1.900	56	0.316	68	0.166	-142	1.00	7.8
1400	0.435	136	1.700	51	0.360	64	0.184	-145	0.99	6.7
1600	0.438	131	1.547	47	0.400	62	0.202	-147	0.99	5.9
1800	0.444	123	1.447	42	0.443	59	0.226	-149	0.98	5.1
2000	0.453	116	1.354	37	0.480	56	0.241	-151	0.97	4.5
2200	0.466	109	1.274	33	0.513	53	0.270	-154	0.96	4.0
2400	0.479	102	1.226	29	0.539	49	0.304	-156	0.96	3.6
2500	0.494	98	1.192	28	0.549	48	0.319	-156	0.95	3.4

See notes on previous page.

3

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (T_A = 25°C)

NE46134

V_{CE} = 8 V, I_C = 100 mA

FREQUENCY (MHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG[2] (dB)
50	.467	-110.1	33.112	120.2	.025	56.9	.518	-70.1	0.52	31.2
100	.437	-143.8	18.512	103.6	.037	62.7	.310	-94.2	0.78	27.0
200	.427	-166.4	9.583	92.1	.063	69.8	.198	-118.6	0.95	21.8
400	.427	176.0	4.926	81.3	.117	73.5	.163	-139.0	1.01	15.6
600	.430	165.3	3.353	73.5	.169	72.8	.161	-147.1	1.03	12.0
800	.432	156.6	2.599	66.7	.222	70.7	.167	-151.2	1.02	9.8
1000	.434	148.6	2.168	60.4	.272	68.5	.177	-153.7	1.02	8.3
1200	.439	141.5	1.873	55.0	.318	65.5	.190	-156.0	1.01	7.1
1400	.446	134.3	1.688	49.5	.362	62.7	.207	-157.6	1.00	6.7
1600	.456	127.3	1.538	45.4	.403	59.6	.221	-158.8	0.99	5.8
1800	.464	119.9	1.419	40.3	.441	56.5	.239	-160.3	0.99	5.1
2000	.473	112.7	1.338	36.3	.475	53.0	.263	-162.3	0.98	4.5
2200	.485	105.7	1.267	31.6	.505	49.6	.289	-163.5	0.97	4.0
2400	.505	98.7	1.196	27.4	.531	46.1	.321	-165.6	0.97	3.5
2500	.515	95.8	1.167	25.6	.539	44.5	.337	-166.2	0.97	3.4

V_{CE} = 10 V, I_C = 50 mA

FREQUENCY (MHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG[2] (dB)
50	0.453	-107	33.713	121	0.029	69	0.531	-64	0.54	30.7
100	0.420	-142	18.960	104	0.034	63	0.317	-84	0.79	27.5
200	0.410	-165	9.847	93	0.061	74	0.187	-105	0.95	22.0
400	0.410	177	5.053	82	0.112	73	0.139	-123	1.01	15.8
600	0.412	167	3.452	74	0.168	73	0.133	-130	1.01	12.4
800	0.414	158	2.676	68	0.213	72	0.139	-136	1.02	10.0
1000	0.418	151	2.219	62	0.262	70	0.151	-140	1.02	8.5
1200	0.420	143	1.920	56	0.314	68	0.161	-141	1.00	7.6
1400	0.425	137	1.722	51	0.357	65	0.180	-144	0.99	6.8
1600	0.432	131	1.570	46	0.401	62	0.196	-146	0.98	5.9
1800	0.443	124	1.465	42	0.443	59	0.216	-149	0.97	5.2
2000	0.448	117	1.372	38	0.477	56	0.241	-151	0.97	4.6
2200	0.459	110	1.306	33	0.509	53	0.270	-153	0.96	4.1
2400	0.481	103	1.227	28	0.536	49	0.299	-154	0.95	3.6
2500	0.489	99	1.205	28	0.549	48	0.321	-156	0.95	3.4

V_{CE} = 10 V, I_C = 100 mA

FREQUENCY (MHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG[2] (dB)
50	0.440	-117	34.984	117	0.025	64	0.463	-71	0.60	31.5
100	0.418	-149	19.063	102	0.034	67	0.271	-93	0.84	27.5
200	0.413	-169	9.811	91	0.061	73	0.166	-115	0.97	22.1
400	0.415	176	5.003	81	0.115	76	0.132	-133	1.02	15.6
600	0.414	166	3.420	74	0.170	75	0.136	-140	1.02	12.1
800	0.415	158	2.656	67	0.222	73	0.143	-144	1.02	10.0
1000	0.418	150	2.200	61	0.267	70	0.151	-146	1.02	8.3
1200	0.425	143	1.899	56	0.317	67	0.162	-148	1.01	7.3
1400	0.430	136	1.710	50	0.361	64	0.179	-149	0.99	6.8
1600	0.440	130	1.554	45	0.403	61	0.196	-151	0.99	5.9
1800	0.443	123	1.445	41	0.442	59	0.210	-153	0.98	5.1
2000	0.452	116	1.360	37	0.479	55	0.238	-154	0.97	4.5
2200	0.457	109	1.275	34	0.511	52	0.260	-156	0.97	4.0
2400	0.478	102	1.234	30	0.536	48	0.292	-158	0.96	3.6
2500	0.487	98	1.200	28	0.548	47	0.312	-159	0.96	3.4

Notes:

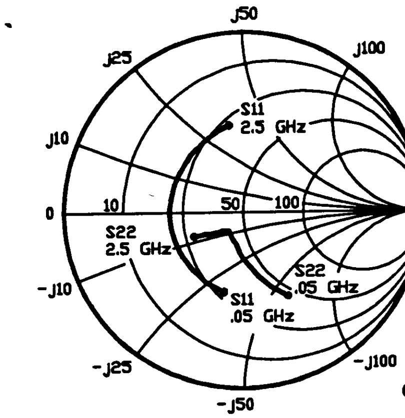
1. The NE41634 was measured with the package mounted on a 0.030" thick RT Duroid 5880 substrate.
   To avoid exceeding Tj MAX when using poor thermal conducting substrates, use of a heat sink is recommended. For example:
   The Thermalloy 7100D series heat sink or thermal equivalent may be suitable. The above S parameters were measured without heat sink.
2. Gain Calculations:

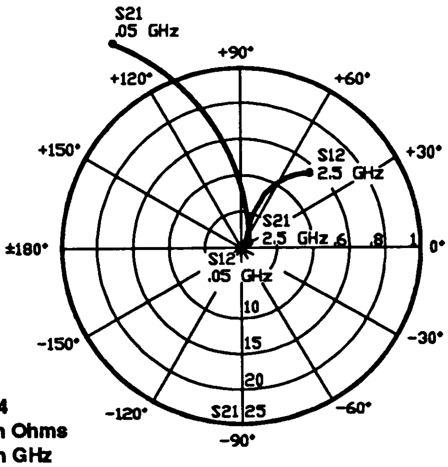
$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right). \text{ When } K \le 1, MAG = MSG. \quad MSG = \frac{|S_{21}|}{|S_{12}|}, \; K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12} S_{21}|}, \; \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (T_A = 25°C)





NE46134
Coordinates in Ohms
Frequency in GHz
V_{CE} = 12.5 V, I_C = 50 mA

NE46134
V_{CE} = 12.5 V, I_C = 50 mA

FREQ (MHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG² (dB)
50	0.464	-104	33.701	122	0.027	60	0.533	-63	0.52	31.0
100	0.419	-140	19.054	105	0.040	64	0.319	-82	0.75	26.8
200	0.409	-164	9.913	93	0.062	71	0.185	-102	0.93	22.0
400	0.407	177	5.085	82	0.115	73	0.139	-121	1.00	16.4
600	0.405	167	3.483	74	0.165	74	0.131	-128	1.02	12.4
800	0.409	159	2.688	68	0.215	72	0.137	-132	1.02	10.2
1000	0.411	152	2.234	62	0.266	69	0.148	-135	1.01	8.8
1200	0.414	144	1.941	56	0.316	68	0.161	-140	1.00	7.9
1400	0.420	137	1.727	51	0.356	65	0.181	-141	0.99	6.9
1600	0.432	131	1.579	46	0.400	62	0.194	-144	0.98	6.0
1800	0.434	124	1.463	42	0.437	59	0.213	-146	0.98	5.2
2000	0.448	117	1.387	38	0.476	56	0.239	-150	0.96	4.6
2200	0.458	109	1.291	33	0.509	53	0.266	-151	0.96	4.0
2400	0.476	102	1.222	29	0.538	50	0.293	-154	0.96	3.6
2500	0.483	99	1.208	28	0.553	48	0.307	-154	0.95	3.4

V_{CE} = 12.5 V, I_C = 100 mA

FREQUENCY (MHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG	K	MAG² (dB)
50	0.451	-114	34,804	117	0.025	55	0.461	-69	0.59	31.4
100	0.421	-146	19,038	102	0.034	62	0.270	-89	0.82	27.5
200	0.408	-167	9,781	91	0.064	72	0.163	-110	0.95	21.9
400	0.412	176	5,009	81	0.115	76	0.129	-131	1.02	15.6
600	0.411	166	3,424	74	0.167	75	0.125	-136	1.03	12.1
800	0.413	158	2,647	67	0.216	72	0.133	-140	1.03	9.9
1000	0.417	150	2,199	61	0.268	70	0.111	-142	1.01	8.4
1200	0.420	143	1,905	56	0.311	68	0.151	-146	1.01	7.2
1400	0.430	137	1,702	50	0.360	64	0.167	-147	0.99	6.7
1600	0.431	130	1,565	46	0.401	62	0.190	-149	0.99	5.9
1800	0.437	123	1,465	41	0.438	59	0.208	-150	0.98	5.2
2000	0.448	116	1,357	37	0.476	56	0.230	-153	0.97	4.6
2200	0.460	109	1,288	33	0.510	52	0.263	-153	0.96	4.0
2400	0.479	102	1,228	28	0.536	49	0.287	-156	0.96	3.6
2500	0.488	99	1,199	27	0.548	48	0.305	-157	0.96	3.4

Notes:

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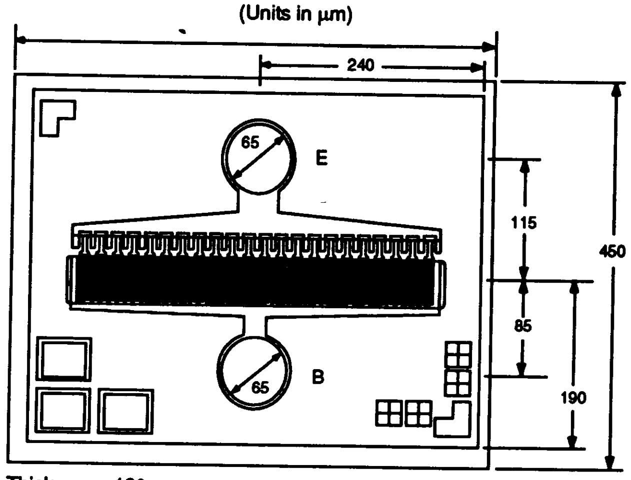
MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

46100 (CHIP)
(Units in μm)



Thickness: 160 μm

PACKAGE OUTLINE 34
(SOT-89)