

NPN SILICON HIGH FREQUENCY TRANSISTOR

NE68000
NE68033
NE68035
NE68037

FEATURES

- **HIGH GAIN BANDWIDTH PRODUCT:** $f_r = 10 \text{ GHz}$
- **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°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	°C	200*
T _{STG}	Storage Temperature	°C	-65 to +150

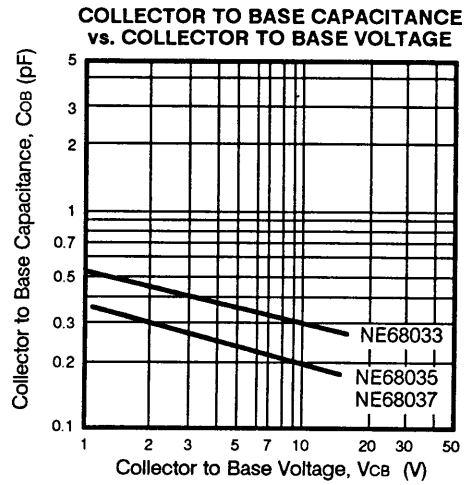
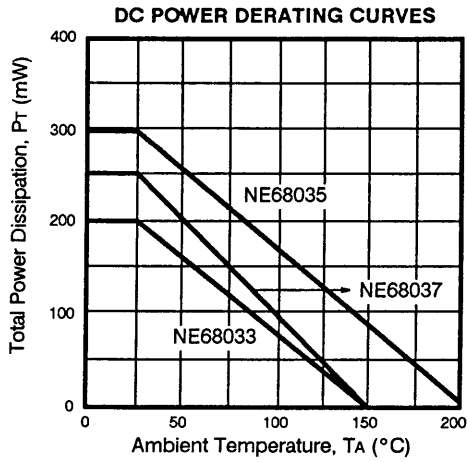
*Maximum T_J for the NE68033 and NE68037 is 150°C.

PERFORMANCE SPECIFICATIONS (T_A = 25°C)

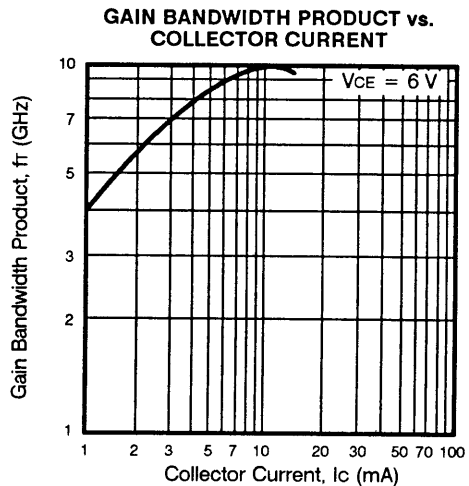
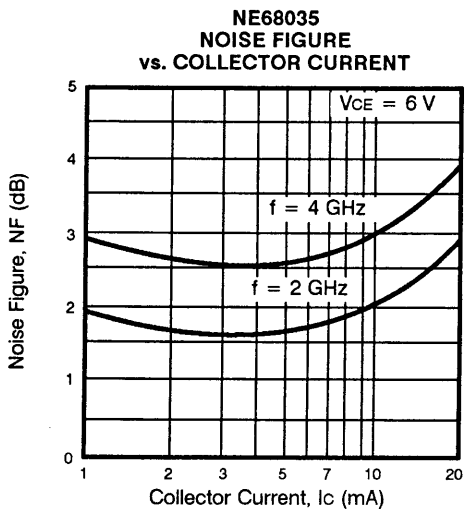
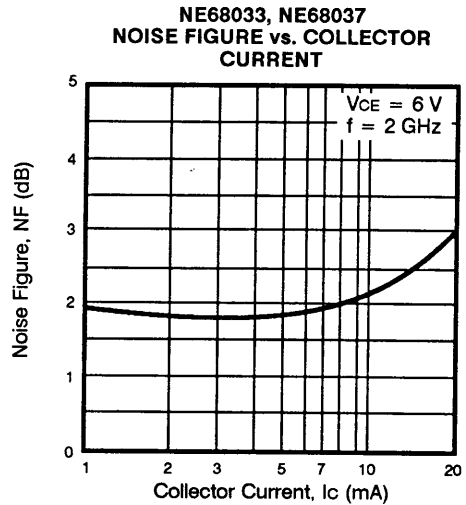
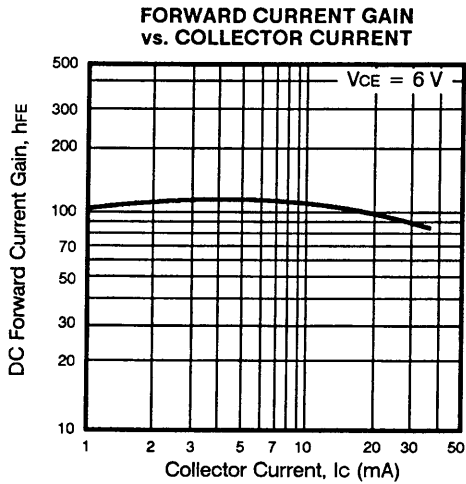
PART NUMBER EIAJ* REGISTERED NUMBER PACKAGE OUTLINE			NE68033 2SC3585 33			NE68035 2SC3587 35			NE68037 2SC3586 37		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f _r	Gain Bandwidth Product at V _{CE} = 6 V, I _c = 10 mA	GHz		10			10			10	
S _{21E} ²	Insertion Power Gain at V _{CE} = 6 V, I _c = 10 mA, f = 2 GHz f = 4 GHz	dB dB	6	8		10.5	12.5 7.5		7.5	9.5	
MAG	Maximum Available Gain at V _{CE} = 6 V, I _c = 10 mA, f = 2 GHz f = 4 GHz	dB dB		10			10			12	
NF	Noise Figure at V _{CE} = 6 V, I _c = 5 mA, f = 2 GHz f = 4 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 V, I _c = 5 mA, f = 2 GHz f = 4 GHz	dB dB		9			12.5 8			11	

*Electronic Industrial Association of Japan.

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

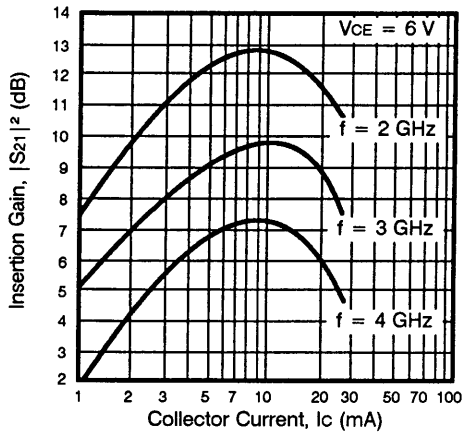


TYPICAL PERFORMANCE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

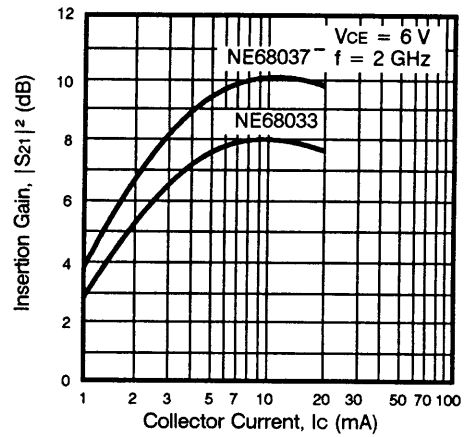


TYPICAL PERFORMANCE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

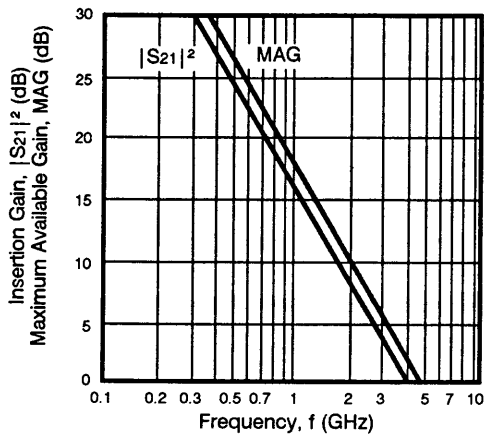
NE68035
INSERTION GAIN vs.
COLLECTOR CURRENT



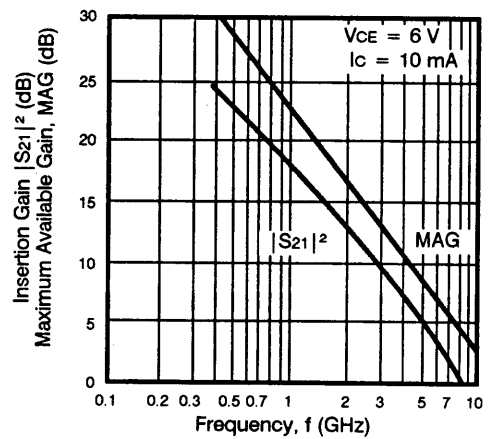
NE68033, NE68037
INSERTION GAIN vs.
COLLECTOR CURRENT



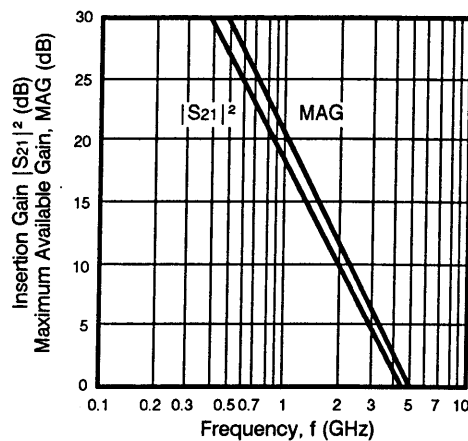
NE68039
FORWARD INSERTION GAIN
AND MAXIMUM AVAILABLE
GAIN vs. FREQUENCY



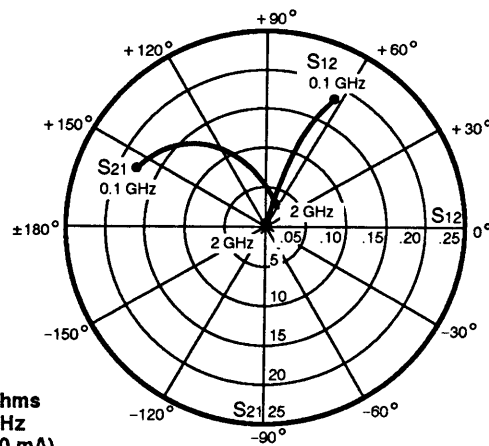
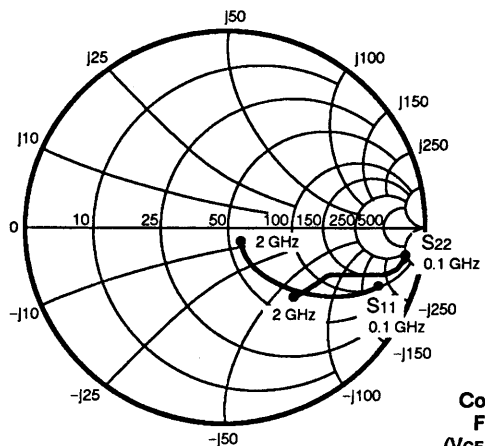
NE68035
FORWARD INSERTION GAIN
AND MAXIMUM AVAILABLE
GAIN vs. FREQUENCY



NE68037
FORWARD INSERTION GAIN
AND MAXIMUM AVAILABLE
GAIN vs. FREQUENCY



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

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	-54	3.95	79	.11	68	.55	-32
1400	.15	-51	3.41	75	.13	67	.55	-34
1600	.14	-52	3.05	70	.15	66	.56	-38
1800	.15	-50	2.72	67	.17	65	.55	-42
2000	.11	-52	2.52	62	.18	63	.53	-45

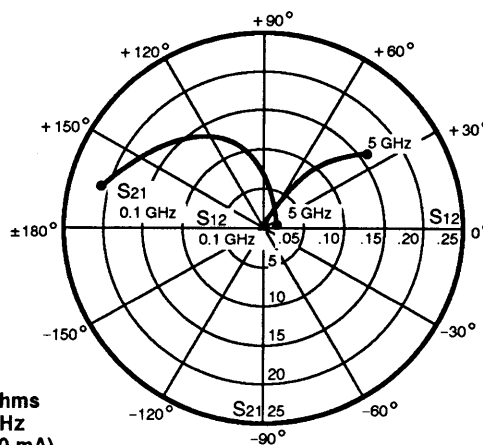
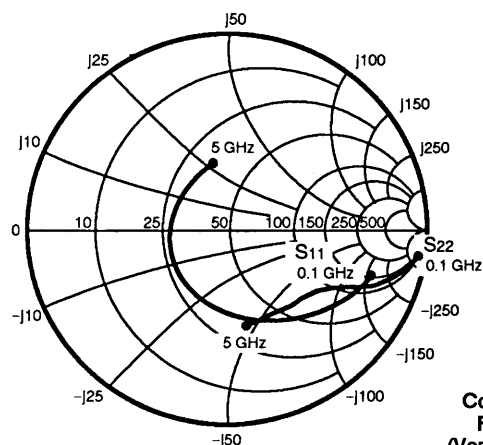
VCE = 6 V, IC = 15 mA

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

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

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

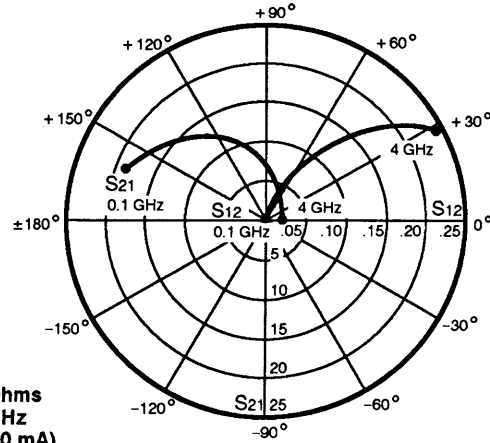
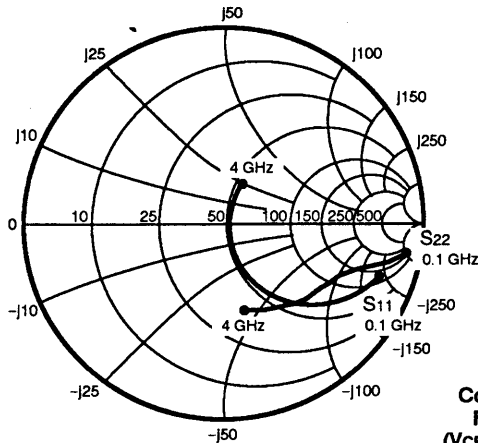
VCE = 6 V, IC = 15 mA

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

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	.55	-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

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

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

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



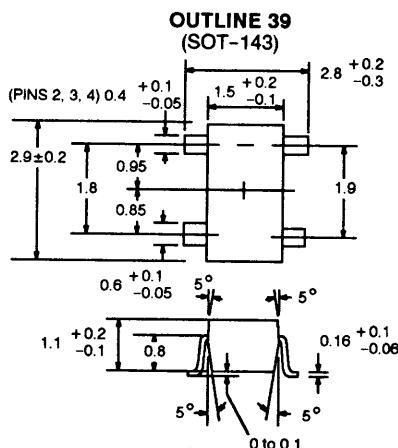
FEATURES

- SURFACE MOUNT COMMON EMITTER PACKAGE
- LOW NOISE FIGURE: 1.8 dB TYP at $f = 2$ GHz
- HIGH POWER GAIN: 10 dB TYP at $f = 2$ GHz
- LOW COST
- AVAILABLE IN TAPE & REEL OR BULK
- HIGH GAIN BANDWIDTH PRODUCT: $f = 10$ GHz

DESCRIPTION AND APPLICATIONS

The NE68039 is an NPN silicon epitaxial transistor designed for low noise, high gain amplifier applications in the VHF-UHF frequency range. It utilizes surface mount packaging technology. This device has two emitter leads to reduce emitter inductance which provides high gain at high frequencies.

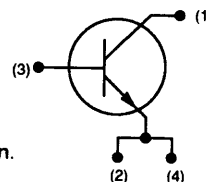
OUTLINE DIMENSIONS (Units in mm)



PIN CONNECTIONS

1. Collector
2. Emitter
3. Base
4. Emitter

Note: Pin 1 is used for orientation.



ABSOLUTE MAXIMUM RATINGS (TA = 25°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
P _T	Total Power Dissipation	mW	200
T _J	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 to +150

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			NE68039 39		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I _{CB0}	Collector Cutoff Current at V _{CB} = 10 V, I _E = 0	μA			1.0
I _{EB0}	Emitter Cutoff Current at V _{EB} = 1 V, I _C = 0	μA			1.0
h _{FE}	Forward Current Gain at V _{CE} = 6 V, I _C = 10 mA		50	100	250
NF	Noise Figure at V _{CE} = 6 V, I _C = 5 mA, f = 2 GHz	dB		1.8	
GA	Associated Gain at V _{CE} = 6 V, I _C = 5 mA, f = 2 GHz	dB		9.0	
S _{21E} ²	Insertion Power Gain at V _{CE} = 6 V, I _C = 10 mA, f = 2 GHz	dB	6.0	8.0	
MAG	Maximum Available Gain at V _{CE} = 6 V, I _C = 10 mA, f = 2 GHz	dB		10.0	
C _{RE}	Feedback Capacitance at V _{CB} = 10 V, I _E = 0, f = 1 MHz	pF		0.2	
R _{TH}	Thermal Resistance (Junction-to-Ambient)	°C/W			500
f _T	Gain Bandwidth Product at V _{CE} = 6 V, I _C = 10 mA	GHz		10.0	