

NEC[®]**NPN SILICON HIGH
FREQUENCY TRANSISTOR****NE02139
NE02139B**

T-31-15

FEATURES

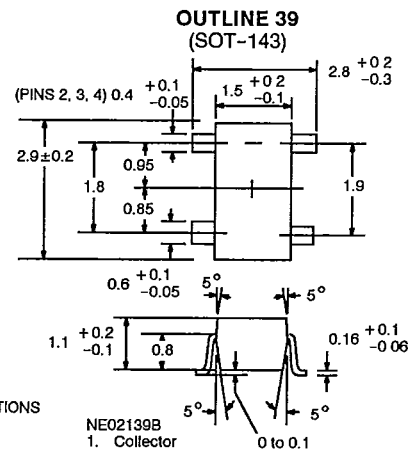
- **LOW NOISE FIGURE**
1.5 dB at 1.0 GHz (TYP)
- **HIGH INSERTION GAIN**
10 dB at 1.0 GHz (TYP)
- **HIGH POWER GAIN**
14 dB at 1.0 GHz (TYP)
- **HIGH GAIN BANDWIDTH PRODUCT:**
4.0 GHz (TYP)
- **SURFACE MOUNT COMMON BASE OR COMMON
EMITTER PACKAGE**
- **AVAILABLE IN TAPE & REEL AND BULK**
- **HIGH RELIABILITY METALLIZATION**
- **LOW COST**

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CB0}	Collector to Base Voltage	V	25
V_{CE0}	Collector to Emitter Voltage	V	12
V_{EB0}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	70
P_T	Total Power Dissipation	mW	200
T_J	Junction Temperature	$^\circ\text{C}$	150
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +150

DESCRIPTION AND APPLICATIONS

The NE02139 and NE02139B NPN silicon transistors provide an economical solution to a wide range of amplifier and oscillator applications requiring surface mount technologies. The devices feature a low noise figure and high current capability providing wide dynamic ranges. The 4-leaded mini mold package provides superior mechanical stability and is available either individually or on tape & reel in two configurations. The NE02139 has two emitter leads to help reduce emitter inductance and the NE02139B has two base leads making it a superior choice for oscillator applications.

OUTLINE DIMENSIONS (Units in mm)

PIN CONNECTIONS
NE02139
 1. Collector
 2. Emitter
 3. Base
 4. Emitter
NE02139B
 1. Collector
 2. Base
 3. Emitter
 4. Base

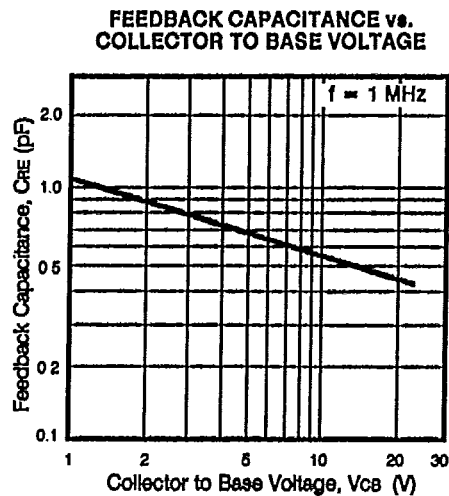
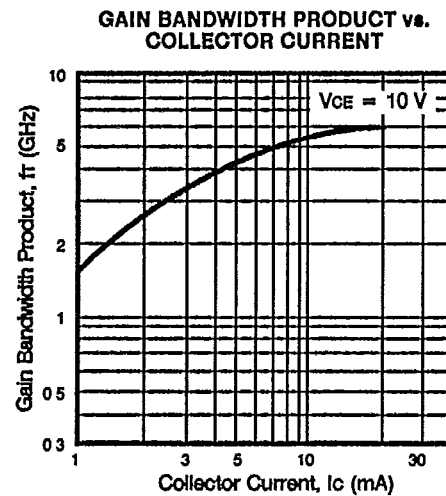
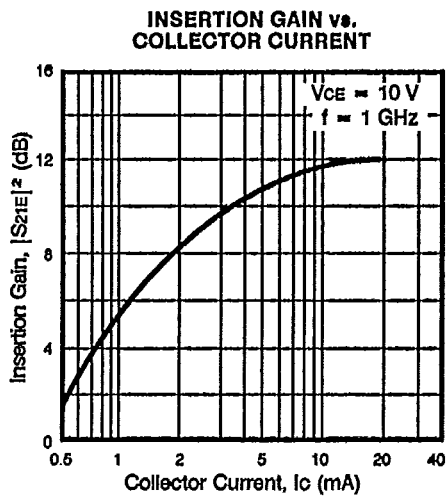
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

PART NUMBER EIAJ* REGISTERED NUMBER PACKAGE OUTLINE			NE02139 2SC4092 39			NE02139B 2SC4089 39B		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
I_{CBO}	Collector Cutoff Current at $V_{CB} = 15\text{ V}$, $I_E = 0$	μA			1.0			1.0
I_{EBO}	Emitter Cutoff Current at $V_{EB} = 2\text{ V}$, $I_C = 0$	μA			1.0			1.0
h_{FE}^{**}	Forward Current Gain at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$		40	70	200	40	70	200
$V_{CE(SAT)}$	Collector Saturation Voltage at $I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$	V					0.09	0.5
f_T	Gain Bandwidth Product at $V_{CE} = 10\text{ V}$, $I_E = 5.0\text{ mA}$, $I_C = 20\text{ mA}$	GHz		4 4.5		2.5	4 4.5	
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$, $f = 1\text{ GHz}$	dB	9	10				
MAG	Maximum Available Gain at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$, $F = 1\text{ GHz}$	dB		14				
NF	Noise Figure at $V_{CE} = 10\text{ V}$, $I_C = 20\text{ mA}$, $F = 1\text{ GHz}$	dB		1.5				
C_{OB}	Output Capacitance at $F = 1.0\text{ MHz}$, $V_{CB} = 10\text{ V}$, $I_E = 0$	pF					0.95	
$C_{C\cdot RB'b}$	Collector to Base Time Constant at $F = 31.9\text{ MHz}$, $V_{CE} = 10\text{ V}$, $I_E = 50\text{ mA}$	pS					4	
R_{TH}	Thermal Resistance (Junction-to-Ambient)	$^\circ\text{C/W}$			500			500

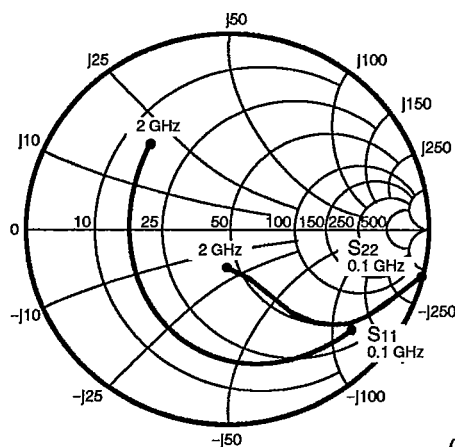
*Electronic Industrial Association of Japan

** h_{FE} Classification

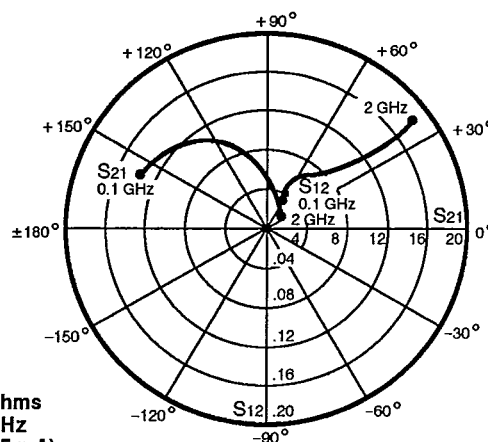
MARKING	R4	R5
HFE	49 to 120	100 to 200

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

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE02139
Coordinates in Ohms
Frequency in GHz
(VCE = 10 V, IC = 5 mA)



S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

FREQUENCY (MHz)

	S11		S21		S12		S22	
100	.78	-39	13.96	156	.027	63	.91	-21
200	.71	-74	11.81	131	.058	62	.77	-36
400	.57	-114	7.51	107	.081	42	.54	-50
600	.50	-143	5.68	93	.093	39	.42	-56
800	.49	-164	4.16	72	.104	37	.35	-59
1000	.49	-180	3.50	81	.117	37	.30	-63
1200	.51	168	2.83	55	.129	37	.27	-66
1400	.52	160	2.59	63	.144	36	.25	-73
1600	.53	150	2.19	49	.155	38	.22	-79
1800	.53	142	2.09	42	.173	36	.21	-88
2000	.56	135	1.79	36	.181	36	.19	-98

VCE = 10 V, IC = 10 mA

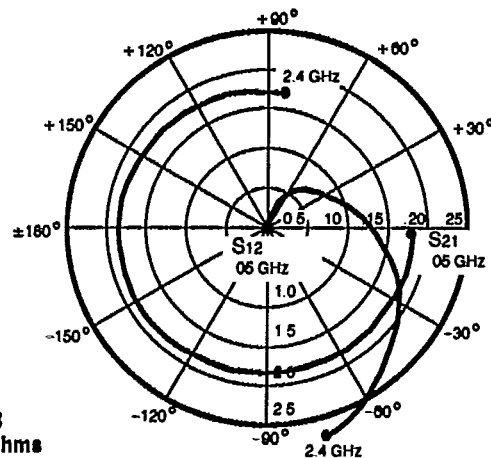
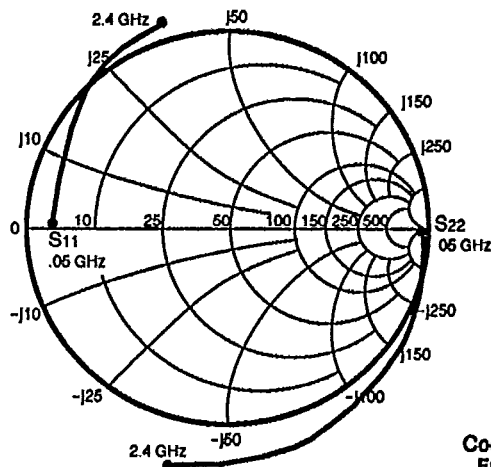
	S11		S21		S12		S22	
100	.63	-58	20.38	145	.025	58	.81	-31
200	.56	-98	15.27	119	.039	60	.61	-45
400	.47	-139	8.90	98	.062	44	.39	-57
600	.45	-164	6.48	87	.073	50	.30	-60
800	.45	180	4.66	76	.091	49	.25	-63
1000	.47	168	3.89	69	.109	50	.21	-68
1200	.48	157	3.13	61	.126	48	.18	-71
1400	.50	152	2.86	54	.143	44	.17	-80
1600	.51	143	2.41	48	.160	46	.14	-88
1800	.52	136	2.30	42	.181	42	.14	-99
2000	.54	130	1.97	36	.191	41	.12	-113

VCE = 10 V, IC = 20 mA

	S11		S21		S12		S22	
100	.53	-82	25.86	136	.021	35	.72	-41
200	.47	-121	17.23	110	.033	61	.48	-51
400	.43	-157	9.44	92	.051	50	.30	-58
600	.44	-177	6.74	83	.069	57	.23	-60
800	.45	170	4.82	74	.090	55	.20	-61
1000	.46	161	4.01	67	.107	54	.16	-66
1200	.48	152	3.23	39	.127	54	.14	-71
1400	.50	147	2.95	53	.149	50	.13	-80
1600	.51	139	2.48	47	.164	50	.10	-91
1800	.52	133	2.36	41	.187	45	.10	-104
2000	.55	127	2.02	36	.197	44	.09	-121

NE02139, NE02139B

TYPICAL COMMON BASE SCATTERING PARAMETERS



NE02139B
Coordinates in Ohms
Frequency in GHz
(V_{CB} = 10 V, I_C = 10 mA)

S-MAGN AND ANGLES:

VCB = 10 V, I_C = 5 mA

FREQUENCY (MHz)

	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
50	.78	178	1.77	-6	.001	69	.99	-2
100	.78	177	1.77	-11	.002	80	1.00	-3
200	.78	174	1.77	-22	.005	85	1.00	-6
300	.79	171	1.77	-33	.008	85	1.00	-10
400	.79	168	1.77	-44	.012	84	1.01	-13
500	.79	165	1.77	-55	.016	81	1.01	-16
600	.80	162	1.77	-66	.020	77	1.02	-20
700	.81	159	1.77	-77	.026	72	1.03	-23
800	.82	156	1.77	-88	.033	66	1.04	-27
900	.83	153	1.78	-100	.040	60	1.04	-30
1000	.84	150	1.78	-111	.048	53	1.06	-34
1100	.86	147	1.78	-123	.058	45	1.07	-38
1200	.87	144	1.78	-134	.068	38	1.08	-42
1300	.89	141	1.78	-146	.079	29	1.10	-46
1400	.90	138	1.78	-158	.092	21	1.11	-51
1500	.92	135	1.78	-170	.106	12	1.13	-55
1600	.94	132	1.77	178	.120	3	1.14	-60
1700	.96	129	1.77	166	.136	-6	1.16	-65
1800	.97	125	1.76	153	.153	-16	1.18	-70
1900	.99	122	1.74	140	.171	-26	1.19	-76
2000	1.00	119	1.72	128	.189	-36	1.21	-81
2100	1.02	116	1.70	115	.209	-46	1.23	-87
2200	1.03	112	1.67	101	.228	-57	1.24	-93
2300	1.04	109	1.64	88	.248	-68	1.25	-99
2400	1.04	106	1.60	74	.268	-78	1.26	-105

VCB = 10 V, I_C = 10 mA

	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
50	.87	178	1.85	-5	.001	64	.99	-2
100	.87	177	1.85	-11	.002	81	1.00	-3
200	.87	174	1.85	-22	.004	92	1.00	-6
300	.87	171	1.85	-32	.006	97	1.00	-10
400	.88	168	1.85	-43	.009	96	1.01	-13
500	.88	165	1.85	-54	.014	93	1.01	-16
600	.88	161	1.85	-65	.019	88	1.02	-19
700	.90	159	1.86	-76	.025	83	1.02	-23
800	.90	156	1.86	-87	.031	76	1.03	-26
900	.92	153	1.86	-98	.039	69	1.04	-30
1000	.93	150	1.86	-109	.048	62	1.05	-34
1100	.94	147	1.86	-120	.058	53	1.07	-38
1200	.95	144	1.87	-131	.069	45	1.08	-42
1300	.97	141	1.87	-143	.081	36	1.09	-46
1400	.99	138	1.87	-154	.094	27	1.11	-50
1500	1.00	135	1.87	-166	.108	18	1.12	-55
1600	1.02	132	1.86	-178	.124	8	1.14	-59
1700	1.04	129	1.86	170	.140	-2	1.16	-64
1800	1.06	126	1.85	158	.158	-12	1.17	-69
1900	1.07	123	1.84	146	.176	-22	1.19	-74
2000	1.09	120	1.82	133	.196	-32	1.21	-80
2100	1.10	117	1.81	121	.216	-43	1.22	-85
2200	1.12	113	1.78	108	.236	-53	1.24	-91
2300	1.13	110	1.75	95	.257	-64	1.25	-97
2400	1.14	106	1.72	82	.278	-75	1.26	-103