

NEC[®]**NPN SILICON HIGH
SPEED SWITCHING TRANSISTOR**NE98200
NE98203
NE98208
NE98241

T-31-21

FEATURES

- WIDE DYNAMIC RANGE
- HIGH GAIN BANDWIDTH PRODUCT: $f_r = 7$ GHz
- 400 PICO SECOND SWITCHING TIME
- HIGH RELIABILITY GOLD METALLIZATION
- USEFUL AS AN OSCILLATOR UP TO 6 GHz

DESCRIPTION AND APPLICATIONS

The NE982 series of NPN silicon transistors features a high gain bandwidth product, and wide dynamic range. The series is designed for medium level microwave amplifier and oscillator applications up to 6 GHz and ultrahigh speed switching applications. The NE98203 and NE98208 are single transistors packaged in rugged metal ceramic stripline packages while the NE98241 dual chip version is designed for differential amplifiers and CML circuit applications. Reliability is assured by NEC's high reliability gold metallization system and quality control procedures patterned after MIL-S-19500.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CB0}	Collector to Base Voltage	V	20
V_{CE0}	Collector to Emitter Voltage	V	8
V_{EB0}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	80*
T_J	Junction Temperature	$^\circ\text{C}$	200
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +200

* $I_C = 200$ mA max; $PW \leq 5$ μs , duty cycle $\leq 10\%$.**PERFORMANCE SPECIFICATIONS** ($T_A = 25^\circ\text{C}$)

PART NUMBER EIAJ ¹ REGISTERED PART NUMBER PACKAGE OUTLINE			NE98203 2SC1660 (Grd C) 03			NE98208 08			NE98241 2SC1662 (Grd C) 41		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f_r	Gain Bandwidth Product at $V_{CE} = 6$ V, $I_C = 30$ mA	GHz	6	7		6	7		6	7	
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 6$ V, $I_C = 30$ mA, $f = 1$ GHz $f = 2$ GHz $f = 3$ GHz	dB dB dB	12	13 7.5 4		12	13 7.5 4				
T_x	Switching Time ² at $V_{CE} = 6$ V, $I_C = 20$ mA	ηs		0.4			0.4			0.4	
MAG	Maximum Available Gain ³ at $V_{CE} = 6$ V, $I_C = 30$ mA, $f = 1$ GHz $f = 2$ GHz $f = 3$ GHz	dB dB dB		15 9.5 6			15 9.5 6			15 9.5 6	
Posc	Oscillator Power Output at $V_{CE} = 6$ V, $I_C = 20$ mA, $f = 6$ GHz	mW		20			20				

Notes:

1. Electronic Industrial Association of Japan.
2. In an ECL circuit.

3. Maximum Available Gain (MAG) is calculated from the device S-Parameters using the equation, $MAG = |S_{21E}|^2 \cdot \frac{1}{1 - |S_{11E}|^2} \cdot \frac{1}{1 - |S_{22E}|^2}$

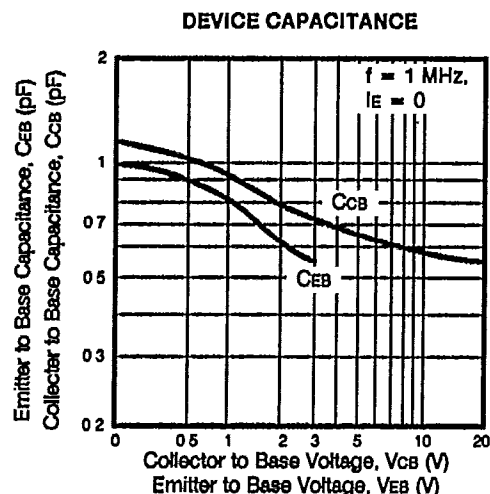
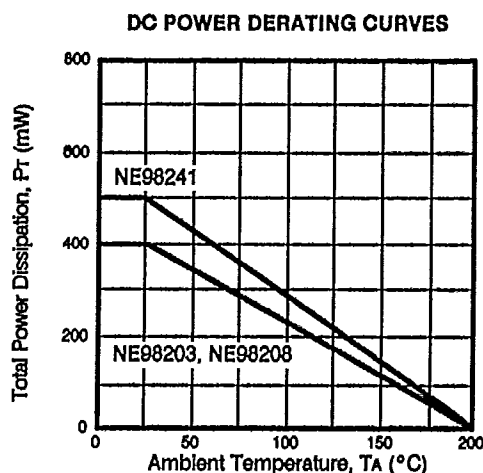
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

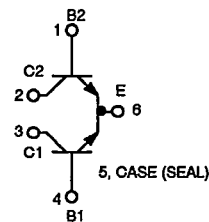
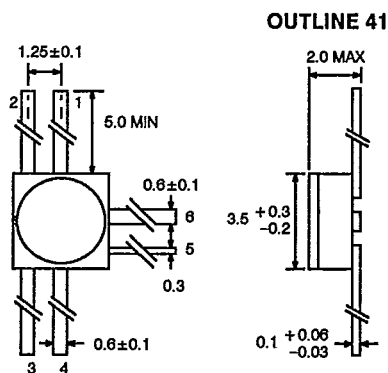
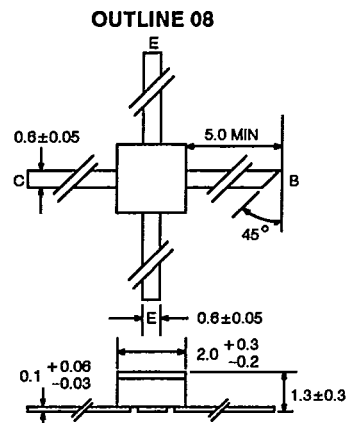
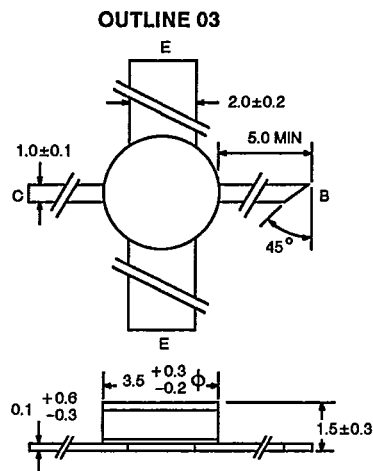
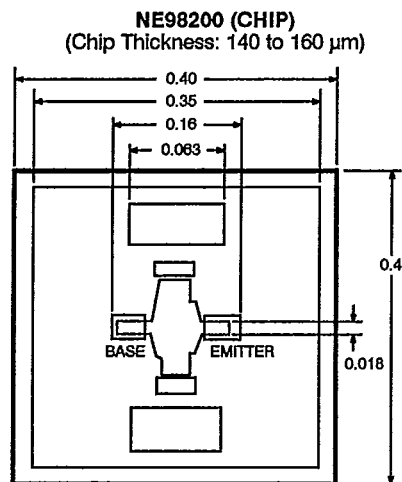
PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE			NE98203 2SC1660 (Grd C) 03			NE98208 08			NE98241 2SC1662 (Grd C) 41		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I_{CBO}	Collector Cutoff Current at $V_{CB} = 6\text{ V}$, $I_E = 0$	μA			0.1			0.1			0.1
I_{EBO}	Emitter Cutoff Current at $V_{EB} = 2\text{ V}$, $I_C = 0$	μA			0.1			0.1			0.1
h_{FE}	Forward Current Gain ² at $V_{CE} = 5\text{ V}$, $I_C = 30\text{ mA}$		30	100	300	30	100	300	30	100	300
h_{FE1} h_{FE2}	Forward Current Gain Delta ³ at $V_{CE} = 5\text{ V}$, $I_C = 30\text{ mA}$								0.6		1
V_{BE}	Base to Emitter Voltage, $V_{CE} = 5\text{ V}$, $I_C = 30\text{ mA}$	V									0.9
ΔV_{BE}	Base to Emitter Voltage Delta, $V_{CE} = 5\text{ V}$, $I_C = 30\text{ mA}$	mV									20
C_{CB}	Collector to Base Capacitance ⁴ at $V_{CB} = 6\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$	pF		0.6	1		0.6	1		0.6	1
$R_{\theta H}$	Thermal Resistance (Junction-to-Case)	$^\circ\text{C/W}$			70			70			90
P_T	Total Power Dissipation Per Device	mW/Unit									350
P_T	Total Power Dissipation	mW			500			500			400

Notes:

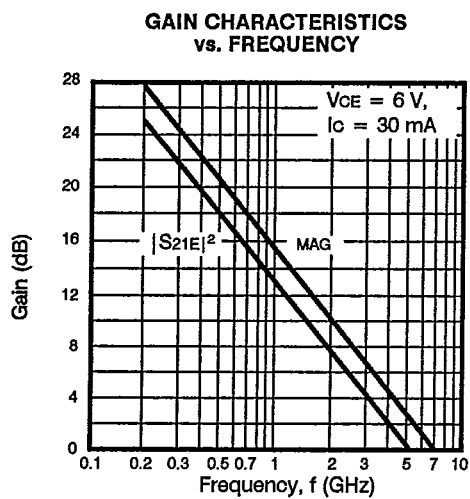
- Electronic Industrial Association of Japan.
- Pulse Width $\leq 350\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$ /pulsed.
- h_{FE2} is smallest of the two.
- C_{CB} measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.

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

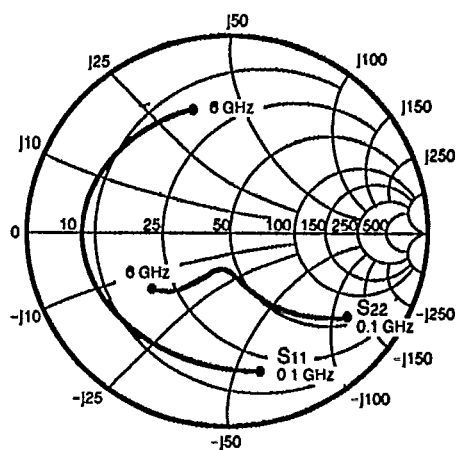


OUTLINE DIMENSIONS (Units in mm)

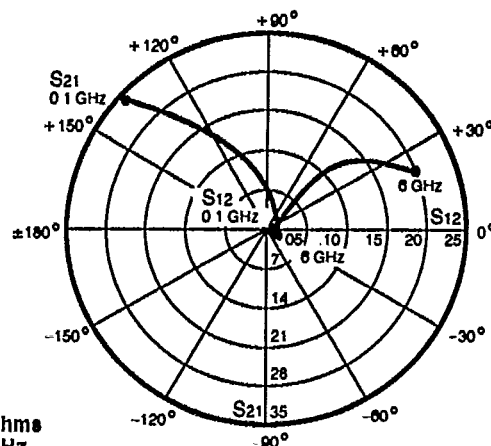
*Lead 5 is only used in manufacturing the device and has no electrical significance.

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

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE98208
Coordinates in Ohms
Frequency in GHz
(VCE = 6 V, IC = 20 mA)



S-MAGN AND ANGLES:

VCE = 6 V, IC = 5 mA

FREQUENCY (MHz)

	S11		S21		S12		S22	
100	.88	-33	14.49	158	.02	75	.95	-18
500	.70	-119	7.68	110	.08	36	.52	-57
1000	.68	-154	4.43	87	.10	26	.36	-74
2000	.66	178	2.31	61	.11	26	.33	-90
3000	.64	158	1.61	39	.13	23	.37	-107
4000	.65	142	1.26	19	.15	20	.42	-120
5000	.62	128	1.04	4	.17	15	.48	-131
6000	.59	112	.86	-12	.20	10	.53	-141

VCE = 6 V, IC = 10 mA

	S11		S21		S12		S22	
100	.80	-52	23.62	149	.02	65	.88	-27
500	.68	-143	9.30	101	.06	35	.37	-69
1000	.69	-169	5.02	82	.07	34	.25	-84
2000	.67	170	2.56	59	.10	40	.25	-98
3000	.66	151	1.78	39	.12	36	.31	-113
4000	.67	137	1.39	21	.15	31	.37	-124
5000	.64	123	1.16	5	.18	23	.43	-135
6000	.61	108	.97	-10	.20	17	.48	-142

VCE = 6 V, IC = 20 mA

	S11		S21		S12		S22	
100	.72	-77	33.16	138	.01	58	.78	-36
500	.70	-159	10.11	95	.04	39	.26	-78
1000	.70	-177	5.28	79	.05	45	.18	-92
2000	.69	166	2.67	58	.09	50	.21	-102
3000	.69	148	1.85	39	.12	42	.28	-115
4000	.69	134	1.44	20	.15	37	.34	-125
5000	.66	120	1.19	5	.18	27	.40	-134
6000	.64	106	.98	-10	.21	21	.46	-141

VCE = 6 V, IC = 30 mA

	S11		S21		S12		S22	
100	.69	-94	36.89	132	.01	56	.71	-40
500	.70	-165	10.15	92	.03	44	.22	-77
1000	.71	179	5.24	77	.04	51	.16	-88
2000	.70	164	2.65	57	.09	53	.20	-98
3000	.69	148	1.83	37	.12	46	.27	-112
4000	.70	134	1.42	19	.15	40	.34	-123
5000	.67	120	1.18	3	.18	30	.41	-133
6000	.65	106	.96	-12	.21	23	.47	-140