

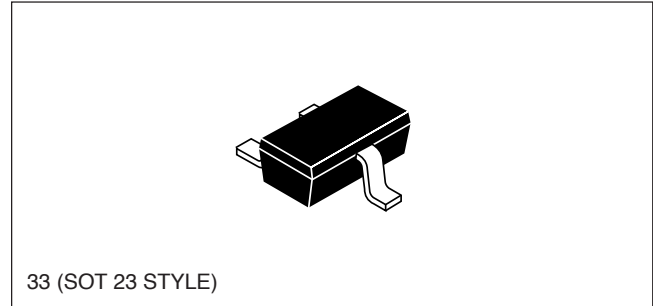


PNP SILICON HIGH FREQUENCY TRANSISTOR

NE97833

FEATURES

- **HIGH GAIN BANDWIDTH PRODUCT:**
 $f_T = 5.5 \text{ GHz TYP}$
- **HIGH SPEED SWITCHING CHARACTERISTICS**
- **NPN COMPLIMENT AVAILABLE:** NE02133
- **HIGH INSERTION POWER GAIN:**
 $IS_{21E}^2 = 10 \text{ dB at } 1 \text{ GHz}$



DESCRIPTION

NEC's NE97833 PNP silicon transistor is designed for ultrahigh speed current mode switching applications and microwave amplifiers up to 3.5 GHz. The NE97833 offers excellent performance and reliability at low cost.

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

PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE			NE97833 2SA1978 33		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
f_T	Gain Bandwidth Product at $V_{CE} = -10 \text{ V}$, $I_C = -15 \text{ mA}$	GHz	4.0	5.5	
NF	Noise Figure at $V_{CE} = -10 \text{ V}$, $I_C = -3 \text{ mA}$	dB		2.0	3.0
IS_{21E}^2	Insertion Power Gain at $V_{CE} = -10 \text{ V}$, $I_C = -15 \text{ mA}$, $f = 1 \text{ GHz}$	dB	8.0	10.0	
h_{FE}	Forward Current Gain Ratio at $V_{CE} = -10 \text{ V}$, $I_C = -15 \text{ mA}$		20	40	100
I_{CBO}	Collector Cutoff Current at $V_{CB} = -10 \text{ V}$, $I_E = 0$	μA			-0.1
I_{EBO}	Emitter Cutoff Current at $V_{BE} = -2 \text{ V}$, $I_C = 0$	μA			-0.1
C_{RE}^2	Feedback Capacitance at $V_{CB} = -10 \text{ V}$, $I_E = 0 \text{ mA}$, $f = 1 \text{ MHz}$	pF		0.5	1.0
P_T	Total Power Dissipation	mW			200

Notes:

1. Electronic Industrial Association of Japan.
2. Capacitance is measured with emitter and case connected to the guard terminal at the bridge.

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

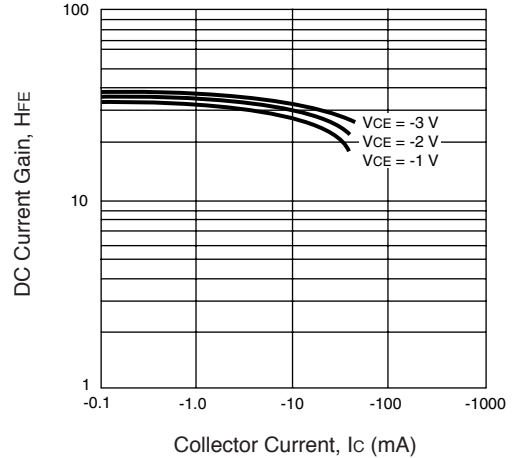
SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CBO}	Collector to Base Voltage	V	-20
V _{CEO}	Collector to Emitter Voltage	V	-12
V _{EBO}	Emitter to Base Voltage	V	-3
I _C	Collector Current	mA	-50
T _J	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 to +200

Note:

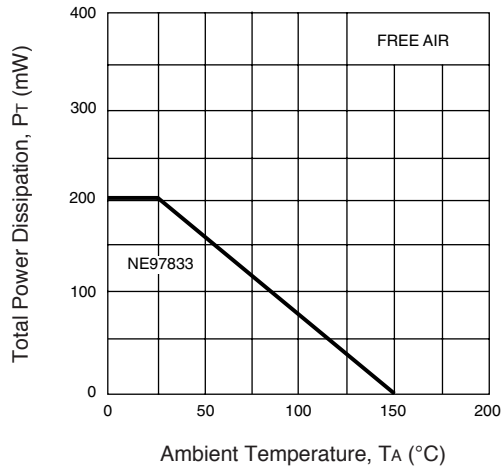
1. Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

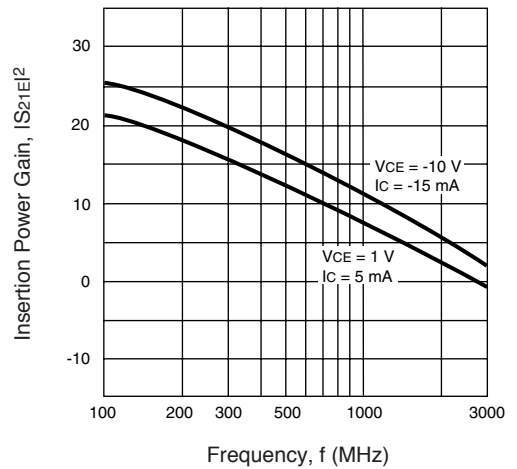
DC CURRENT GAINS vs. COLLECTOR CURRENT



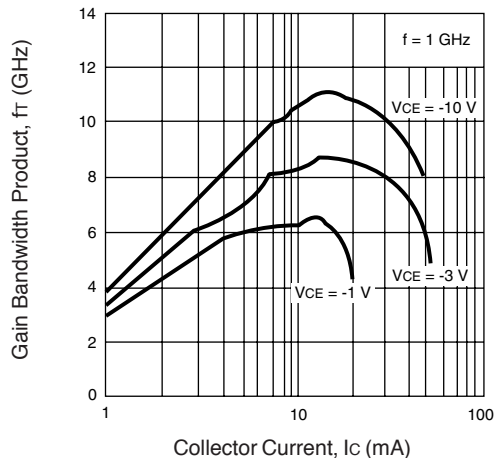
DC POWER DERATING CURVES



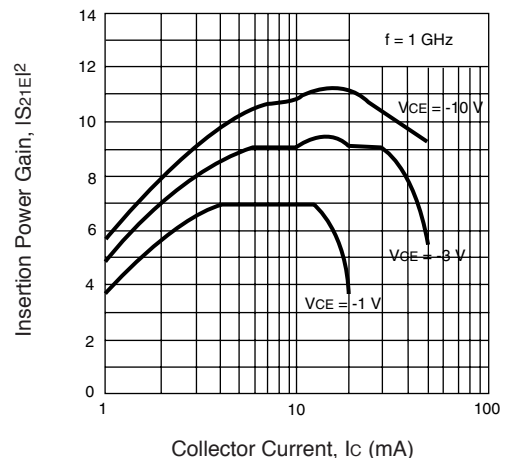
INSERTION GAIN vs. FREQUENCY



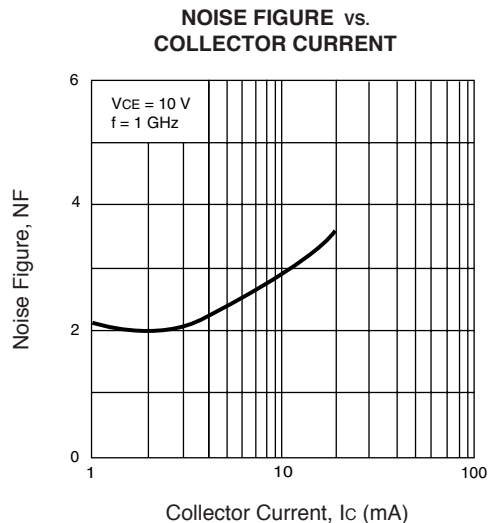
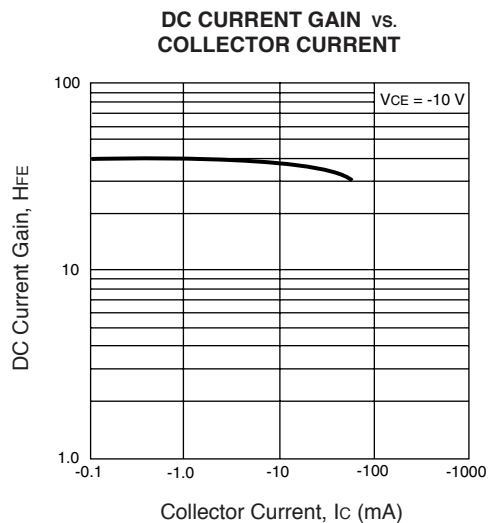
GAIN BANDWIDTH vs. COLLECTOR CURRENT



INSERTION GAIN vs. COLLECTOR CURRENT



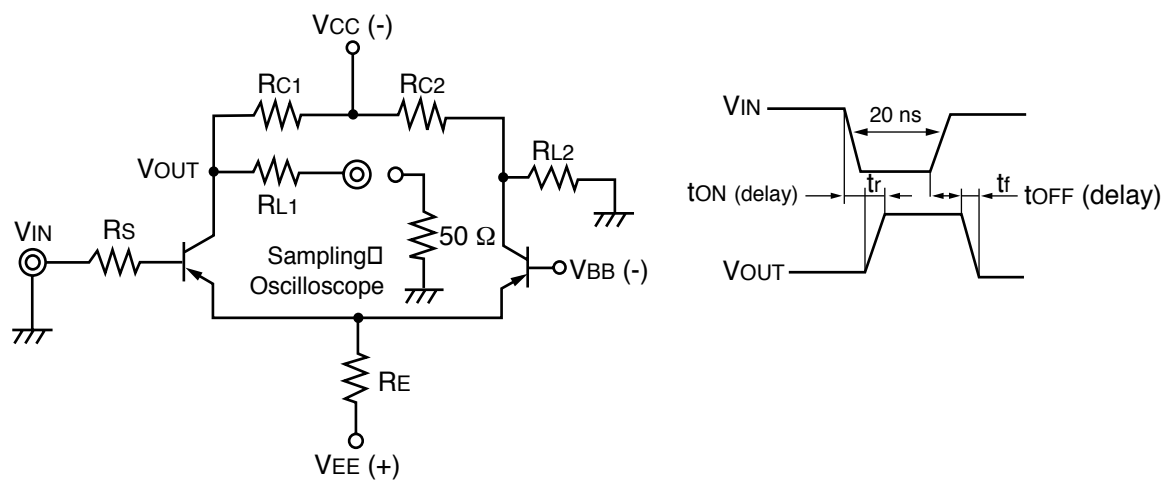
TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$)



SWITCHING CHARACTERISTICS

UNITS	PARAMETERS	UNITS	$V_{IN} = 1\text{ V}$
			TYP
t_{ON} (delay)	Turn-on Delay Time	ns	1.10
t_r	Rise Time	ns	0.77
t_{OFF} (delay)	Turn-off Delay Time	ns	0.40
t_f	Fall Time	ns	0.79

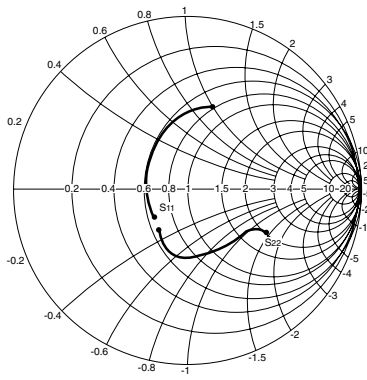
SWITCHING TIME MEASUREMENT CIRCUIT



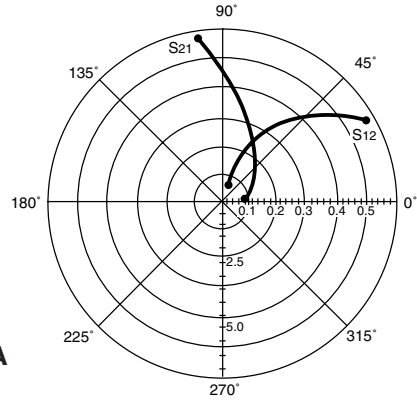
$V_{IN} = 1\text{ V}, V_{BB} = -0.5\text{ V}, R_{C1} = R_{C2}$

R_s (Ω)	R_c (Ω)	R_{L1} (Ω)	R_{L2} (Ω)	R_E (Ω)	V_{EE} (V)	V_{CC} (V)
160	1 K	200	250	2.7 K	27	26.3

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



NE97833
VCE = -8 V, I_c = -10 mA



VCE = -5 V, I_c = -10 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG ¹ (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.50	0.274	-149.2	6.102	96.9	0.063	68.1	0.493	-30.9	0.97	19.9
0.80	0.273	-177.0	4.037	82.0	0.093	70.1	0.432	-32.2	1.07	14.7
1.00	0.278	169.8	3.303	74.5	0.114	70.3	0.412	-34.5	1.09	12.8
1.50	0.308	144.6	2.311	58.7	0.170	68.1	0.381	-44.8	1.08	9.6
2.00	0.352	125.0	1.808	45.3	0.229	63.9	0.362	-59.4	1.03	7.8
2.50	0.402	109.1	1.496	33.5	0.288	58.3	0.359	-75.9	0.99	7.2
3.00	0.449	96.4	1.281	23.6	0.345	52.4	0.364	-91.0	0.95	5.7
4.00	0.506	79.7	1.023	9.1	0.458	40.7	0.350	-113.5	0.91	3.5
5.00	0.527	71.1	0.908	-1.8	0.574	27.4	0.246	-138.8	0.92	2.0

VCE = -8 V, I_c = -10 mA

0.50	0.252	-140.2	6.426	98.5	0.060	68.7	0.523	-29.0	0.95	20.3
0.80	0.240	-171.6	4.270	83.5	0.089	70.6	0.463	-30.1	1.05	15.4
1.00	0.243	173.7	3.496	76.0	0.109	70.9	0.443	-32.3	1.08	13.4
1.50	0.272	145.9	2.445	60.5	0.162	60.5	0.515	-43.9	1.11	9.8
2.00	0.316	125.3	1.911	47.2	0.219	65.0	0.393	-55.2	1.02	8.4
2.50	0.369	109.0	1.582	35.6	0.276	59.8	0.388	-70.6	0.98	7.6
3.00	0.418	96.4	1.353	25.5	0.333	54.2	0.392	-85.0	0.94	6.1
4.00	0.479	79.9	1.076	10.7	0.445	42.9	0.379	-106.3	0.90	3.8
5.00	0.503	71.7	0.950	-0.4	0.563	30.2	0.278	-127.3	0.90	2.3

VCE = -10 V, I_c = -15 mA

0.50	0.555	-80.8	4.097	116.8	0.076	55.1	0.697	-28.4	0.65	17.3
0.80	0.399	-121.8	3.325	94.8	0.094	53.5	0.600	-32.6	0.89	15.5
1.00	0.348	-143.5	2.864	84.2	0.106	55.4	0.564	-35.2	1.00	14.3
1.50	0.314	173.5	2.107	64.5	0.140	69.0	0.411	-39.4	1.07	10.2
2.00	0.342	142.8	1.669	49.0	0.186	62.8	0.494	-56.1	1.08	7.8
2.50	0.393	120.2	1.382	36.0	0.241	61.5	0.490	-70.2	1.00	7.4
3.00	0.446	103.4	1.179	25.6	0.302	57.9	0.496	-83.7	0.93	5.9
4.00	0.515	81.7	0.934	11.9	0.433	47.8	0.484	-105.8	0.87	3.3
5.00	0.529	69.6	0.844	3.0	0.575	34.3	0.382	-128.7	0.90	1.7

VCE = -10 V, I_c = -3 mA

0.50	0.214	-153.1	6.846	96.2	0.058	73.2	0.506	-27.0	0.99	20.7
0.80	0.215	179.7	4.489	82.4	0.087	74.0	0.456	-27.9	1.06	15.6
1.00	0.221	166.8	3.664	75.4	0.108	73.7	0.439	-30.1	1.07	13.7
1.50	0.254	141.5	2.554	60.6	0.163	70.6	0.441	-41.8	1.05	10.6
2.00	0.300	122.3	1.992	47.7	0.220	66.0	0.393	-52.7	1.01	8.9
2.50	0.352	107.1	1.648	36.2	0.276	60.4	0.387	-68.0	0.97	7.8
3.00	0.402	95.0	1.410	26.3	0.331	54.6	0.389	-82.1	0.94	6.3
4.00	0.463	79.5	1.121	11.3	0.440	43.4	0.377	-102.6	0.89	4.1
5.00	0.489	72.1	0.984	-0.2	0.555	31.0	0.277	-121.3	0.89	2.5

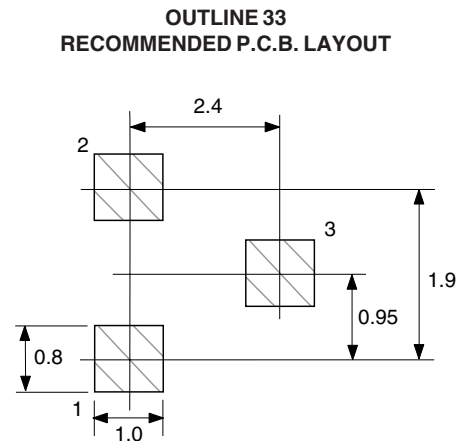
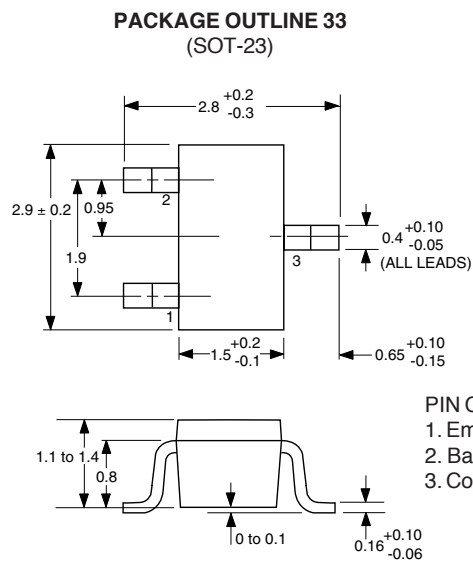
Note:

1. Gain Calculation:

$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1}). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } MSG = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)



ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
NE97833-T1B-A	3000	Tape & Reel

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

EXCLUSIVE NORTH AMERICAN AGENT FOR **NEC** RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

CEL CALIFORNIA EASTERN LABORATORIES • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279
24-Hour Fax-On-Demand: 800-390-3232 (U.S. and Canada only) • Internet: <http://WWW.CEL.COM>

DATA SUBJECT TO CHANGE WITHOUT NOTICE

PRINTED IN USA ON RECYCLED PAPER -7/98

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall CEL’s liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.