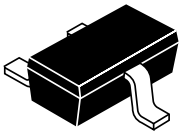
CEL

PNP SILICON HIGH FREQUENCY TRANSISTOR

NE97833

FEATURES

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



33 (SOT 23 STYLE)

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°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 V, I_C = -15 mA	GHz	4.0	5.5	
NF	Noise Figure at V_{CE} = -10 V, I_C = -3 mA	dB		2.0	3.0
$\|S_{21E}\|^2$	Insertion Power Gain at V_{CE} = -10 V, I_C = -15 mA, f = 1 GHz	dB	8.0	10.0	
h_{FE}	Forward Current Gain Ratio at V_{CE} = -10 V, I_C = -15 mA		20	40	100
I_{CBO}	Collector Cutoff Current at V_{CB} = -10 V, I_E = 0	μA			-0.1
I_{EBO}	Emitter Cutoff Current at V_{BE} = -2 V, I_C = 0	μA			-0.1
C_{RE}[2]	Feedback Capacitance at V_{CB} = -10 V, I_E = 0 mA, f = 1 MHz	pF		0.5	1.0
P_T	Total Power Dissipation	mW			200

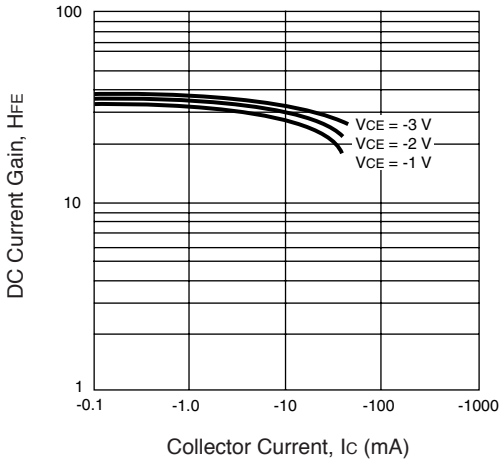
Notes:
1. Electronic Industrial Association of Japan.
2. Capacitance is measured with emitter and case connected to the guard terminal at the bridge.

ABSOLUTE MAXIMUM RATINGS[1] (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

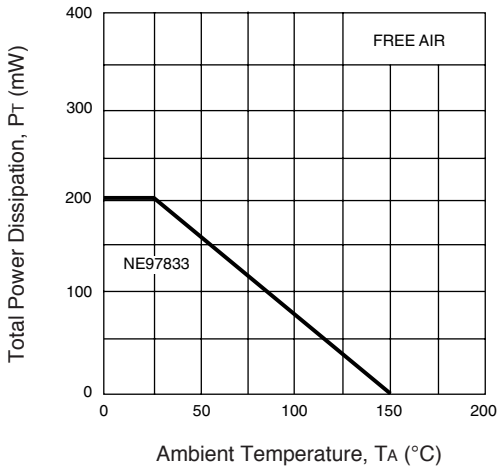
Note:
1. Operation in excess of any one of these parameters may result in permanent damage.

DC CURRENT GAINS vs. COLLECTOR CURRENT

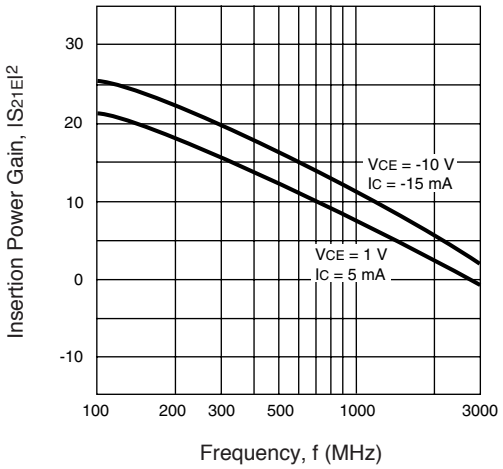


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

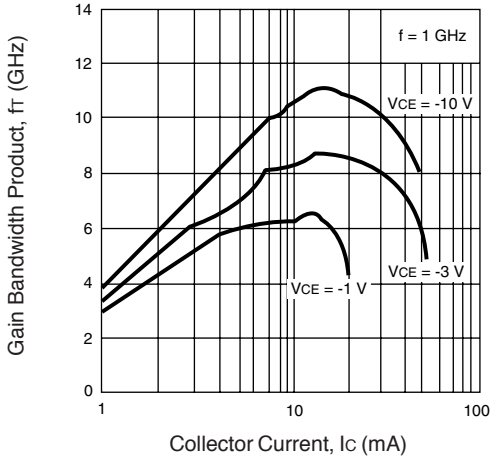
DC POWER DERATING CURVES



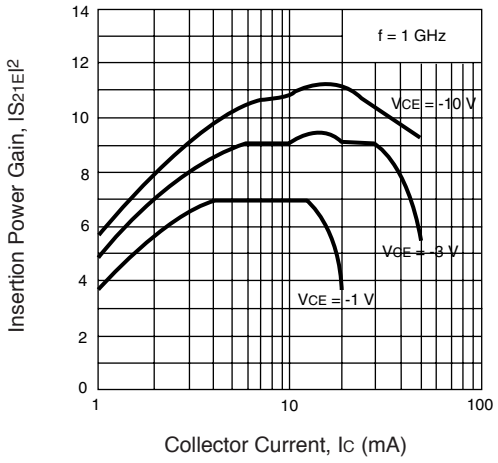
INSERTION GAIN vs. FREQUENCY



GAIN BANDWIDTH vs. COLLECTOR CURRENT

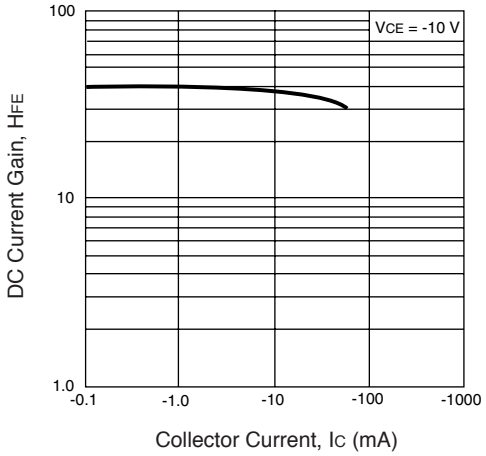


INSERTION GAIN vs. COLLECTOR CURRENT

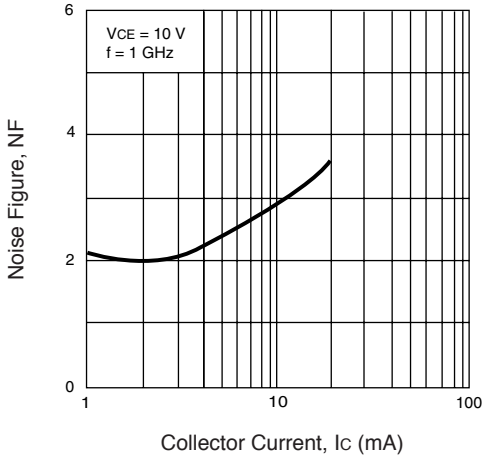


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

DC CURRENT GAIN vs. COLLECTOR CURRENT



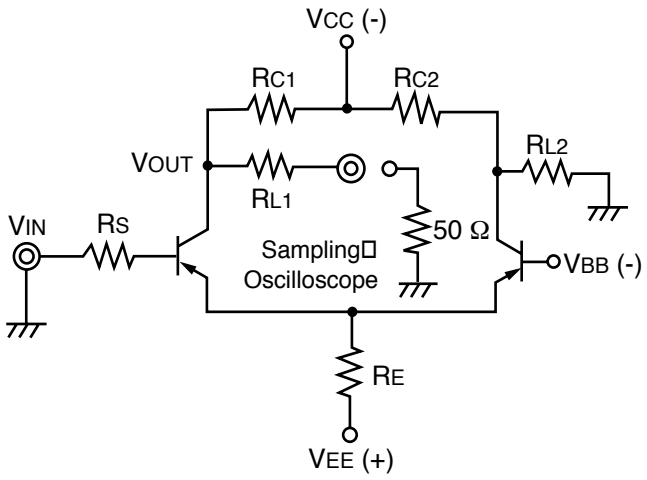
NOISE FIGURE vs. COLLECTOR CURRENT

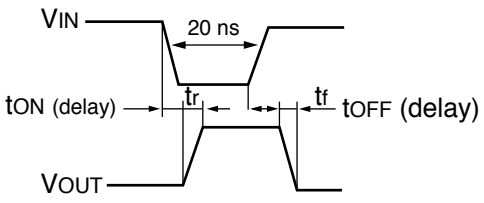


SWITCHING CHARACTERISTICS

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

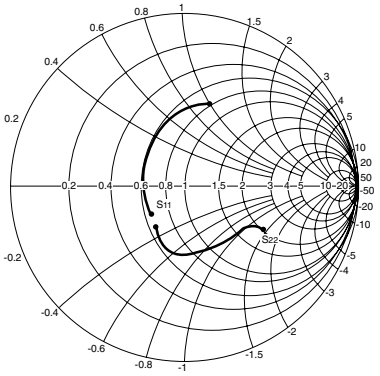
SWITCHING TIME MEASUREMENT CIRCUIT



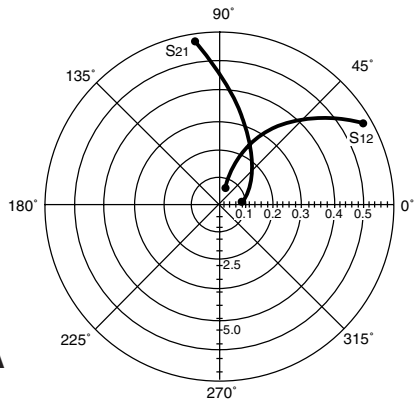


V_{IN} = 1 v, V_{BB} = -0.5 V, R_{C1} = R_{C2}						
R_S (Ω)	R_C (Ω)	R_{L1} (Ω)	R_{L2} (Ω)	R_E (Ω)	V_{EE} (V)	V_{CC} (V)
160	1 K	200	250	2.7 K	27	26.3

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



NE97833
V_{CE} = -8 V, I_C = -10 mA



V_{CE} = -5 V, I_C = -10 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
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

V_{CE} = -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

V_{CE} = -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

V_{CE} = -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:

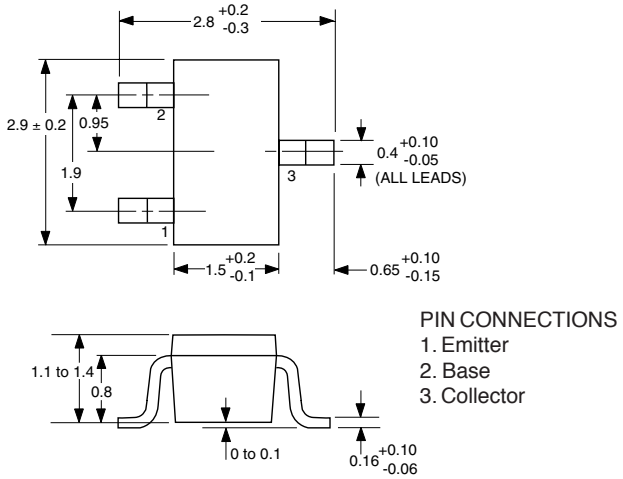
1. Gain Calculation:

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

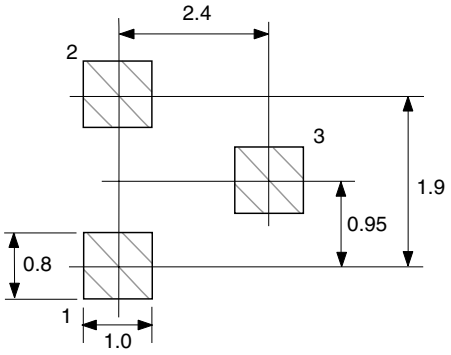
OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 33
(SOT-23)



PIN CONNECTIONS
1. Emitter
2. Base
3. Collector

OUTLINE 33
RECOMMENDED P.C.B. LAYOUT



ORDERING INFORMATION

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

CEL California Eastern Laboratories

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Facsimile: (408) 988-0279

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	
Lead (Pb)	< 1000 PPM	-A	-AZ
		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.