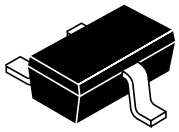
CEL

PNP SILICON HIGH FREQUENCY TRANSISTOR

NE97733

FEATURES

- **HIGH GAIN BANDWIDTH PRODUCT:** f_T = 8.5 GHz TYP
- **HIGH SPEED SWITCHING CHARACTERISTICS**
- **NPN COMPLIMENT AVAILABLE:** NE68133
- **HIGH INSERTION POWER GAIN:** $|S_{21E}|^2$ = 12 dB at 1 GHz



33 (SOT 23 STYLE)

DESCRIPTION

NEC's NE97733 PNP silicon transistor is designed for ultrahigh speed current mode switching applications and microwave amplifiers up to 3.5 GHz. The NE97733 offers excellent performance and reliability at low cost.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER EIAJ[1] REGISTERED NUMBER PACKAGE OUTLINE			NE97733 2SA1977 33		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
f_T	Gain Bandwidth Product at V_{CE} = -8 V, I_C = -20 mA	GHz	6.0	8.5	
NF	Noise Figure at V_{CE} = -8 V, I_C = -3 mA	dB		1.5	3.0
$\|S_{21E}\|^2$	Insertion Power Gain at V_{CE} = -8 V, I_C = -20 mA, f = 1 GHz	dB	8.0	12.0	
h_{FE}	Forward Current Gain Ratio at V_{CE} = -8 V, I_C = -20 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} = -1 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	0.1
P_T	Total Power Dissipation	mW			200

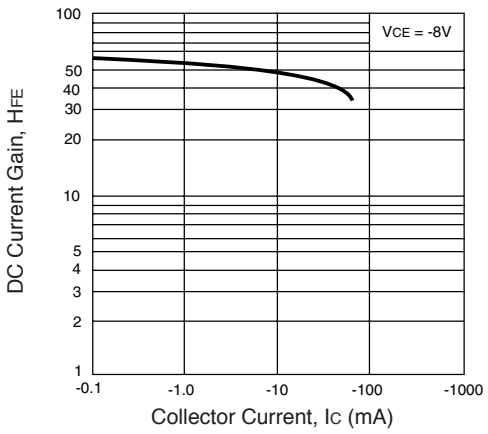
Notes:
1. Electronic Industrial Association of Japan.
2. Capacitance is measured with emitter and case connected to the guard terminal at the bridge.

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

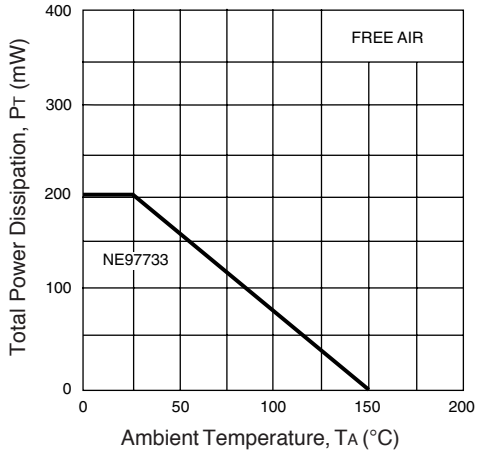
Note:
1. Operation in excess of any one of these parameters may result in permanent damage.

DC CURRENT GAIN vs. COLLECTOR CURRENT

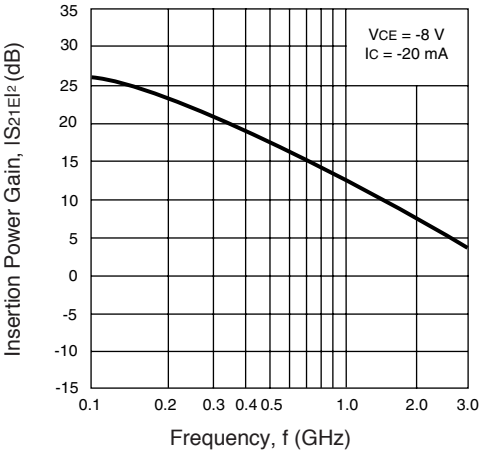


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

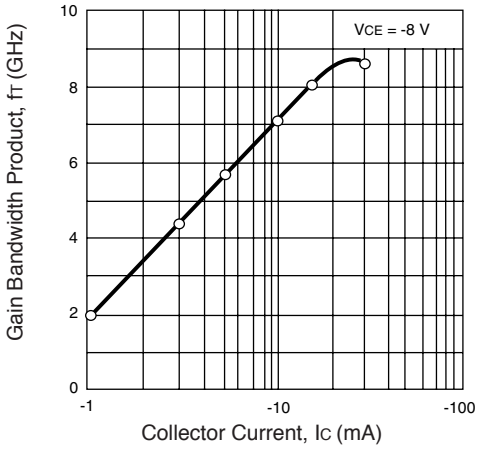
DC POWER DERATING CURVES



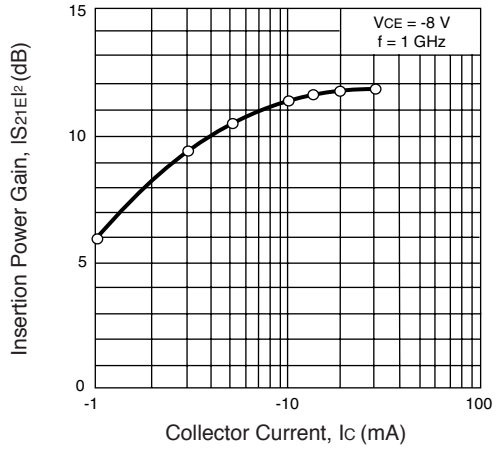
INSERTION GAIN vs. FREQUENCY



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

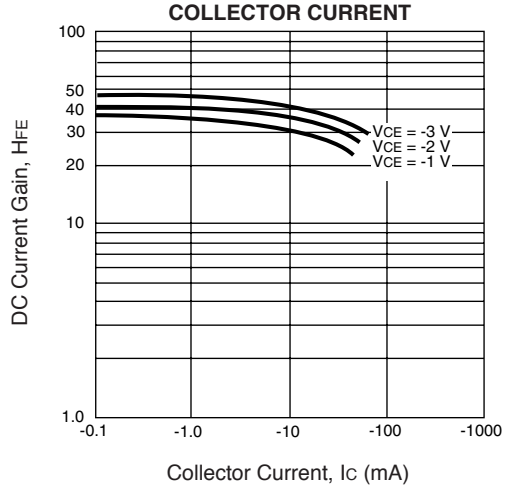


INSERTION GAIN vs. COLLECTOR CURRENT

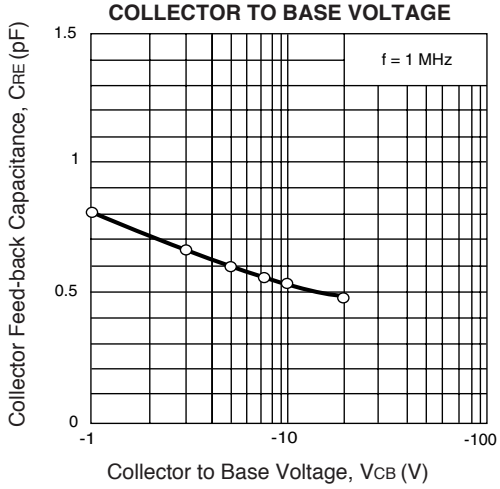


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

DC CURRENT GAIN vs. COLLECTOR CURRENT



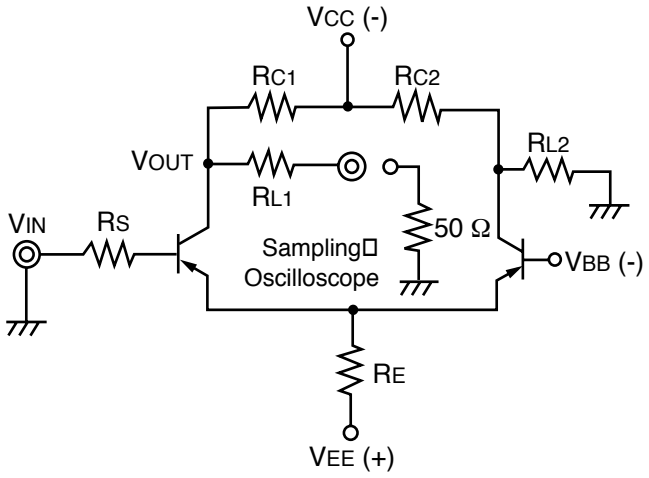
OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE

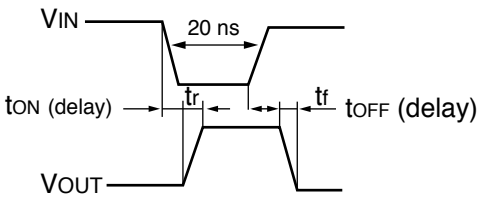


SWITCHING CHARACTERISTICS

Parameter	Symbol	Vin = 1 V TYP	Unit
Turn-on Delay Time	t_{ON} (delay)	1.08	ns
Rise Time	t_r	0.66	ns
Turn-off Delay Time	t_{OFF} (delay)	0.32	ns
Fall Time	t_f	0.78	ns

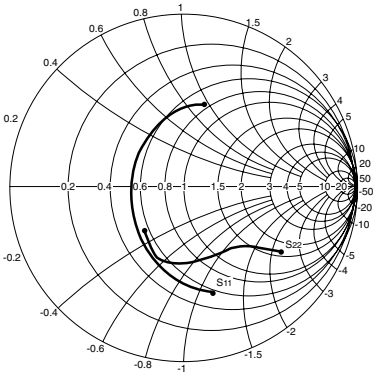
SWITCHING TIME MEASUREMENT CIRCUIT

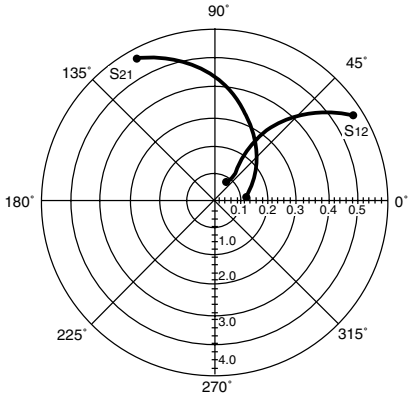




V_{IN} = 1 v, V_{BB} = -0.5 V, R_{C1} = R_{C2}						
R_S (Ω)	R_C (Ω)	R_{L1} (Ω)	R_{L2} (Ω)	R_E (Ω)	V_{EE} (V)	V_{CC} (V)
160	1 K	200	250	2.7 K	27	26.3

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)





97733
V_{CE} = -8 V, I_C = -3 mA

V_{CE} = -1 V, I_C = -5 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	0.428	-126.3	4.899	100.7	0.101	52.7	0.417	-54.0	0.77	16.8
0.80	0.382	-160.6	3.398	82.8	0.132	54.1	0.309	-60.2	0.97	14.1
1.00	0.374	-175.9	2.813	74.1	0.154	55.0	0.272	-64.5	1.04	11.5
1.50	0.387	155.1	2.002	56.8	0.213	54.6	0.230	-80.1	1.09	7.9
2.00	0.419	132.6	1.583	42.6	0.274	51.3	0.226	-100.1	1.07	6.0
2.50	0.461	114.5	1.323	30.6	0.336	46.5	0.247	-119.0	1.04	4.8
3.00	0.502	100.2	1.148	21.0	0.393	40.9	0.270	-133.8	1.01	4.1
4.00	0.552	82.6	0.948	7.0	0.501	29.4	0.267	-159.3	0.98	2.8
5.00	0.574	74.2	0.859	-4.4	0.599	16.0	0.218	155.9	0.98	1.6

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

0.50	0.251	-126.4	7.121	99.1	0.072	67.8	0.426	-38.9	0.91	19.9
0.80	0.213	-159.9	4.739	84.5	0.107	68.2	0.350	-39.9	1.00	16.0
1.00	0.207	-176.4	3.878	77.3	0.131	67.6	0.324	-41.9	1.03	13.7
1.50	0.225	151.5	2.708	62.5	0.191	64.2	0.288	-52.1	1.04	10.3
2.00	0.265	127.7	2.116	49.8	0.252	59.4	0.272	-67.9	1.03	8.2
2.50	0.316	109.8	1.754	38.6	0.310	53.5	0.275	-85.3	1.00	7.2
3.00	0.365	96.8	1.511	28.8	0.364	47.5	0.284	-100.1	0.98	6.2
4.00	0.428	82.3	1.218	13.5	0.467	36.4	0.269	-121.5	0.95	4.2
5.00	0.462	77.7	1.074	0.8	0.566	24.3	0.171	-148.4	0.94	2.8

V_{CE} = -8 V, I_C = -3 mA

0.50	0.626	-74.0	4.205	119.4	0.088	54.6	0.673	-32.7	0.56	16.8
0.80	0.447	-111.0	3.520	97.8	0.109	51.8	0.558	-38.2	0.79	15.1
1.00	0.374	-131.4	3.075	87.0	0.122	52.6	0.512	-41.0	0.91	14.0
1.50	0.302	-174.7	2.293	67.2	0.157	56.0	0.451	-49.9	1.05	10.2
2.00	0.310	151.1	1.824	51.9	0.202	57.8	0.427	-62.0	1.06	8.0
2.50	0.355	125.4	1.516	39.0	0.256	56.7	0.425	-76.0	1.01	7.0
3.00	0.407	106.9	1.301	28.4	0.314	53.7	0.433	-89.1	0.96	6.2
4.00	0.428	85.0	1.038	13.9	0.438	44.7	0.425	-110.2	0.90	3.7
5.00	0.503	74.6	0.930	3.7	0.573	32.3	0.328	-133.5	0.91	2.1

V_{CE} = -8 V, I_C = -20 mA

0.50	0.151	-140.9	8.095	95.5	0.067	74.7	0.389	-34.1	0.98	20.8
0.80	0.140	-172.1	5.268	83.1	0.105	73.5	0.334	-34.1	1.02	16.2
1.00	0.142	172.1	4.288	76.7	0.129	72.2	0.315	-36.1	1.03	14.1
1.50	0.170	141.7	2.974	63.2	0.191	66.9	0.285	-46.2	1.03	10.9
2.00	0.215	119.7	2.317	51.4	0.252	60.8	0.269	-61.6	1.02	8.9
2.50	0.268	104.0	1.918	40.7	0.309	54.6	0.268	-79.2	1.00	7.9
3.00	0.318	92.5	1.652	31.2	0.362	48.4	0.274	-94.3	0.98	6.6
4.00	0.379	80.9	1.332	15.8	0.459	36.9	0.257	-114.2	0.95	4.6
5.00	0.416	79.2	1.169	2.6	0.552	25.3	0.154	-134.6	0.94	3.3

Note:

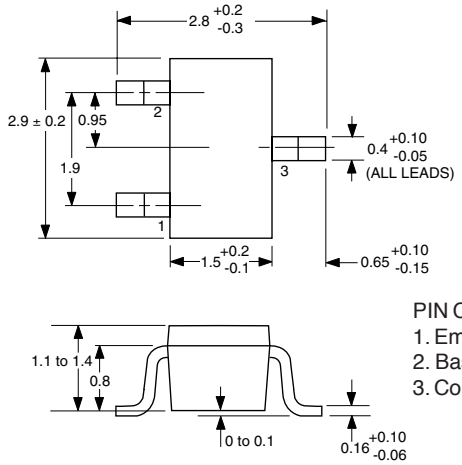
1. Gain Calculation:

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

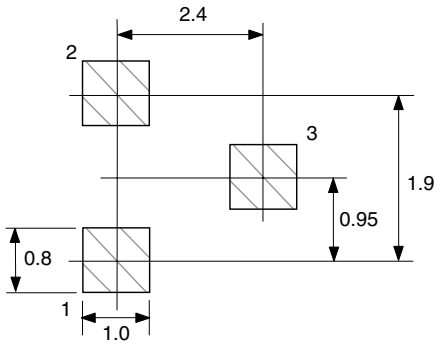
OUTLINE DIMENSIONS (Units in mm)

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
NE97733-T1B-A	3000	Tape & Reel

CEL California Eastern Laboratories

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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.