

NPN 4 GHz wideband transistor



BFQ34T

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DESCRIPTION

NPN transistor in a plastic SOT37 envelope, intended for wideband amplification applications. The device features high output voltage capabilities.

A SOT5 (TO-39) version (ref: ON4497) is available on request.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

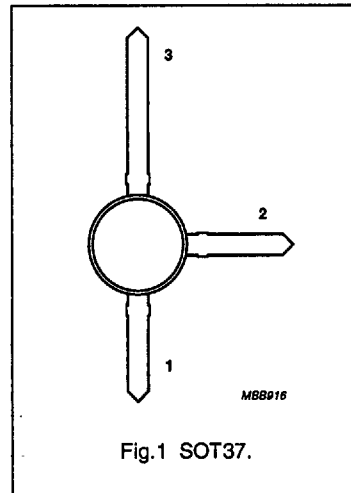


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	—	25	V
V_{CEO}	collector-emitter voltage	open base	—	—	18	V
I_C	collector current		—	—	150	mA
P_{tot}	total power dissipation	up to $T_s = 145^\circ\text{C}$ (note 1)	—	—	1	W
h_{FE}	DC current gain	$I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_j = 25^\circ\text{C}$	25	70	—	
f_T	transition frequency	$I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 800\text{ MHz}$; $T_j = 25^\circ\text{C}$	—	3.7	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 800\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	—	12	—	dB
V_O	output voltage	$d_m = -60\text{ dB}$; $I_C = 90\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\ \Omega$; $T_{amb} = 25^\circ\text{C}$; $f_{(p+q-r)} = 793.25\text{ MHz}$	—	750	—	mV
P_{L1}	output power at 1 dB gain compression	$V_{CE} = 10\text{ V}$; $I_C = 90\text{ mA}$; $f = 800\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	—	22	—	dBm
ITO	third order intercept point	$I_C = 90\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 800\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	—	41	—	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

NPN 4 GHz wideband transistor

BFQ34T

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69E D

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	25	V
V_{CEO}	collector-emitter voltage	open base	—	18	V
V_{EBO}	emitter-base voltage	open collector	—	2	V
I_C	DC collector current		—	150	mA
P_{tot}	total power dissipation	up to $T_s = 145\text{ °C}$ (note 1)	—	1	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		—	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 145\text{ °C}$ (note 1)	30 K/W

Note

- T_s is the temperature at the soldering point of the collector lead.

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69E D

CHARACTERISTICS

 $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0; V_{CB} = 15\text{ V}$	—	—	100	μA
h_{FE}	DC current gain	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}$	25	70	—	
f_T	transition frequency	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 800\text{ MHz}$	—	3.7	—	GHz
C_c	collector capacitance	$I_E = I_{e0} = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	—	2	—	pF
C_e	emitter capacitance	$I_C = I_{c0} = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	—	10	—	pF
C_{re}	feedback capacitance	$I_C = 0; V_{CE} = 10\text{ V}; f = 1\text{ MHz}$	—	1.2	—	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 800\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	—	12	—	dB
d_2	second order intermodulation distortion (Fig.2)	note 2	—	-55	—	dB
V_O	output voltage	note 3	—	1	—	V
		note 4	—	750	—	mV
P_{L1}	output power at 1 dB gain compression	$I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C};$ measured at $f = 800\text{ MHz}$	—	22	—	dBm
ITO	third order intercept point	$I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz};$ $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	41	—	dBm

Notes

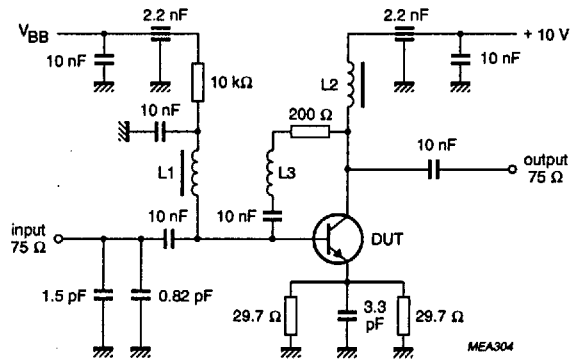
- G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
- $I_C = 60\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ }^{\circ}\text{C};$
 $V_q = V_p = V_O = 48\text{ dBmV}; f_p = 560\text{ MHz};$
 $V_q = V_O = 50\text{ dBmV}; f_q = 250\text{ MHz};$
measured at $f_{(p+q)} = 810\text{ MHz}.$
- $d_{im} = -60\text{ dB (DIN 45004B)}; I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ }^{\circ}\text{C};$
 $V_p = V_O$ at $d_m = -60\text{ dB}; f_p = 287.25\text{ MHz};$
 $V_q = V_O - 6\text{ dB}; f_q = 294.25\text{ MHz};$
 $V_r = V_O - 6\text{ dB}; f_r = 295.25\text{ MHz};$
measured at $f_{(p+q+r)} = 285.25\text{ MHz}.$
- $d_{im} = -60\text{ dB (DIN 45004B)}; I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ }^{\circ}\text{C};$
 $V_p = V_O$ at $d_m = -60\text{ dB}; f_p = 797.25\text{ MHz};$
 $V_q = V_O - 6\text{ dB}; f_q = 803.25\text{ MHz};$
 $V_r = V_O - 6\text{ dB}; f_r = 805.25\text{ MHz};$
measured at $f_{(p+q+r)} = 793.25\text{ MHz}.$

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L1 = L2 = 5 μH Ferrocube choke.

L3 = 2 turns 0.5 mm copper wire; winding pitch 2 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

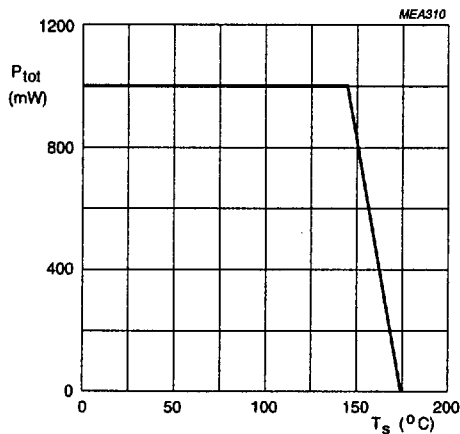
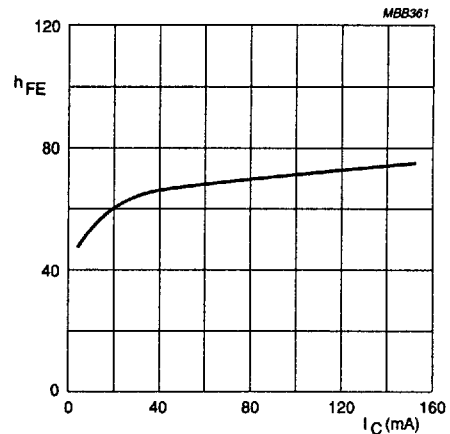


Fig.3 Power derating curve.



$V_{CE} = 10$ V; $T_j = 25$ °C.

Fig.4 DC current gain as a function of collector current.

NPN 4 GHz wideband transistor

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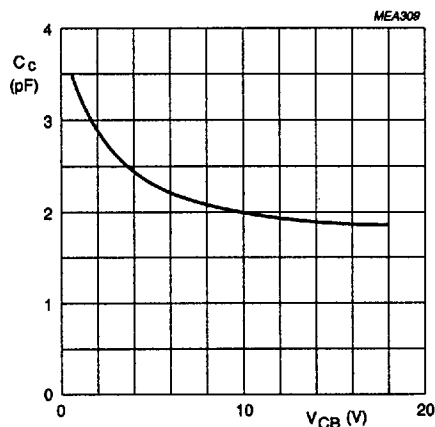
 $I_E = 0$; $f = 1$ MHz; $T_j = 25$ °C.

Fig.5 Collector capacitance as a function of collector-base voltage.

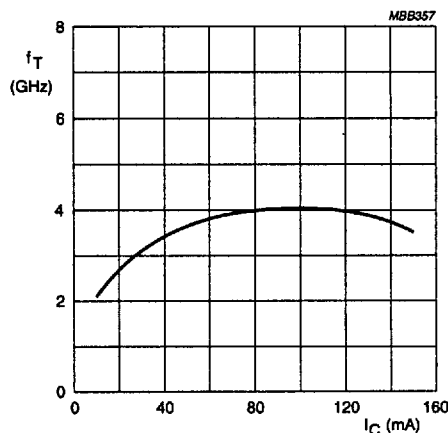
 $V_{CE} = 10$ V; $f = 800$ MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.

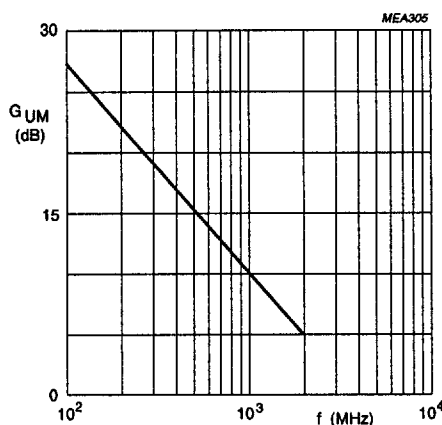
 $I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C.

Fig.7 Maximum unilateral power gain as a function of frequency.

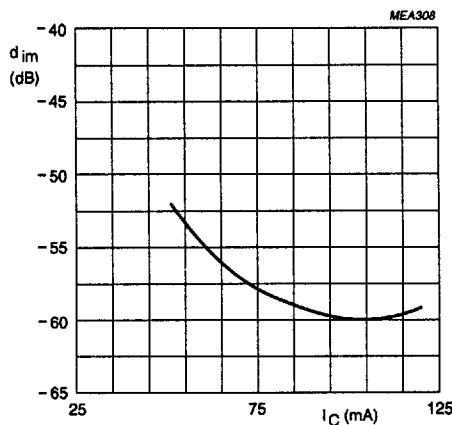
 $V_{CE} = 10$ V; $V_O = 750$ mV; $T_{amb} = 25$ °C;
 $f_{(p-q-r)} = 793.25$ MHz.

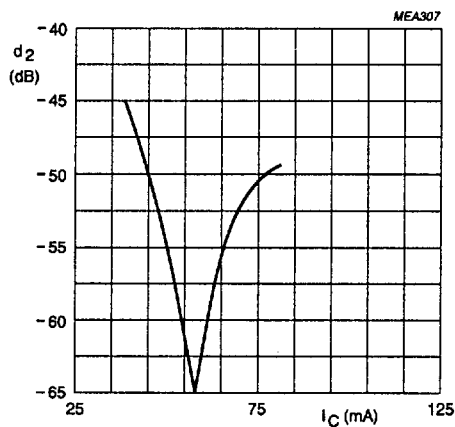
Fig.8 Intermodulation distortion as a function of collector current.

NPN 4 GHz wideband transistor

BFQ34T

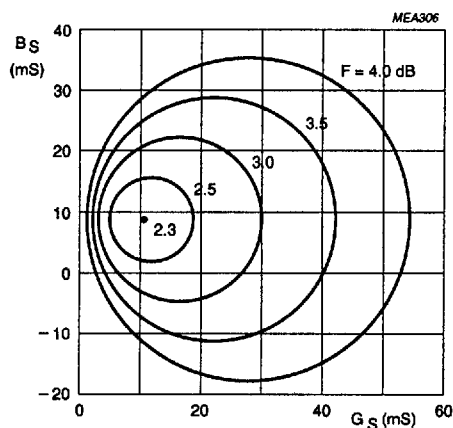
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$V_{CE} = 10$ V; $V_O = 48$ dBmV; $T_{amb} = 25$ °C;
 $f_p = 560$ MHz; $f_q = 250$ MHz; $f_{(p+q)} = 810$ MHz.

Fig.9 Second order intermodulation distortion as a function of collector current.



$I_C = 20$ mA; $V_{CE} = 10$ V; $f = 800$ MHz; $T_{amb} = 25$ °C.

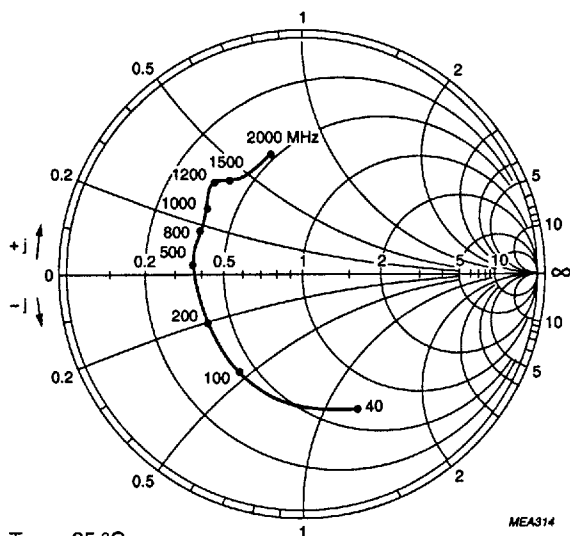
Fig.10 Noise circle figure.

NPN 4 GHz wideband transistor

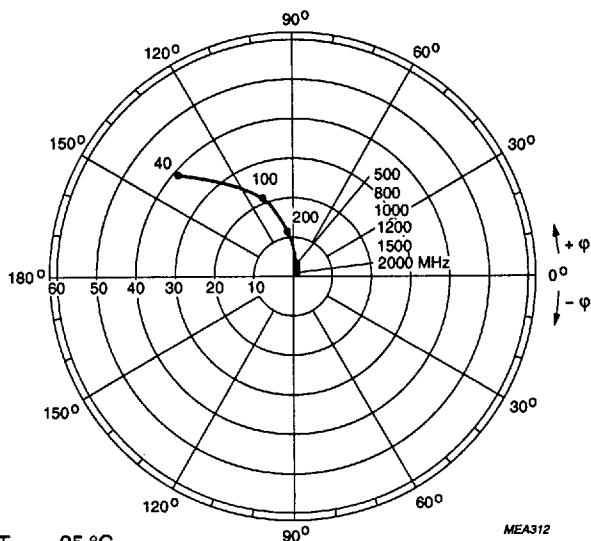
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$I_C = 100 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25^\circ\text{C}$.

Fig.11 Common emitter input reflection coefficient (S_{11}).

$I_C = 100 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25^\circ\text{C}$.

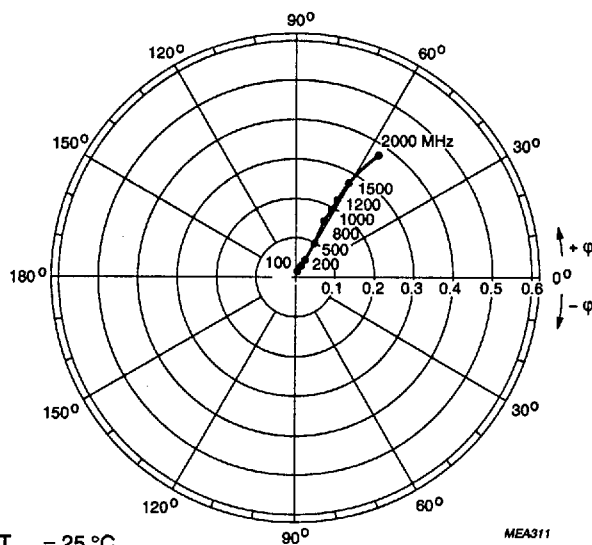
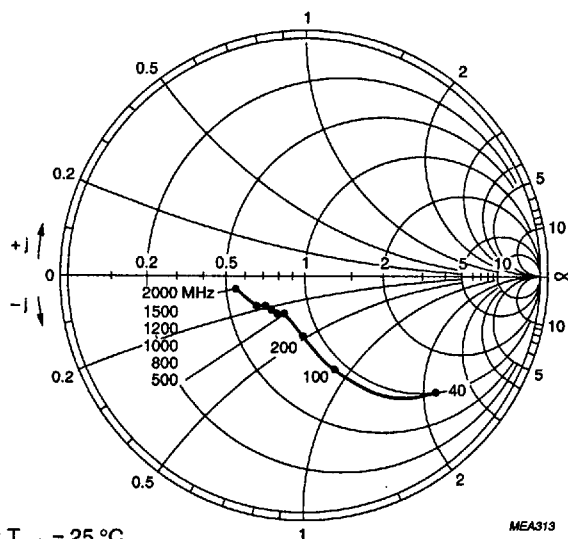
Fig.12 Common emitter forward transmission coefficient (S_{21}).

NPN 4 GHz wideband transistor

BFQ34T

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Fig.13 Common emitter reverse transmission coefficient (S_{12}).Fig.14 Common emitter output reflection coefficient (S_{22}).

NPN 4 GHz wideband transistor

BFQ34T

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Table 1 Common emitter scattering parameters, $I_C = 70$ mA; $V_{CE} = 10$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.459	-73.8	32.733	142.7	0.019	65.0	0.801	-35.7	35.8
100	0.469	-126.0	19.677	116.6	0.033	56.9	0.500	-61.7	28.2
200	0.479	-156.6	10.977	98.5	0.048	58.6	0.307	-78.8	22.4
300	0.483	-171.9	7.424	89.5	0.063	61.8	0.241	-88.2	18.8
400	0.507	179.1	5.674	82.8	0.078	64.1	0.216	-94.6	16.6
500	0.507	172.8	4.597	77.4	0.093	66.0	0.211	-100.5	14.7
600	0.488	165.6	3.858	73.2	0.108	66.2	0.212	-105.1	13.1
700	0.511	159.7	3.356	68.7	0.124	65.8	0.217	-108.3	12.0
800	0.507	153.1	2.937	64.2	0.138	66.5	0.223	-111.7	10.9
900	0.521	147.9	2.643	60.4	0.156	66.1	0.229	-114.9	10.1
1000	0.526	142.5	2.364	56.4	0.172	65.3	0.237	-118.5	9.1
1200	0.554	133.2	2.041	49.9	0.203	63.5	0.254	-127.3	8.1
1400	0.549	125.2	1.760	42.5	0.229	61.7	0.281	-136.1	6.8
1600	0.578	118.3	1.552	36.3	0.263	60.1	0.315	-142.3	6.0
1800	0.580	109.9	1.403	30.5	0.292	56.7	0.344	-148.6	5.3
2000	0.613	100.8	1.302	25.5	0.322	54.6	0.363	-154.8	5.0

Table 2 Common emitter scattering parameters, $I_C = 100$ mA; $V_{CE} = 10$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.463	-74.1	33.964	141.6	0.020	64.0	0.786	-37.5	35.8
100	0.475	-126.8	20.065	115.5	0.033	58.0	0.481	-64.3	28.3
200	0.484	-156.8	11.112	98.0	0.048	57.9	0.294	-82.6	22.5
300	0.479	-173.0	7.528	89.3	0.062	61.6	0.230	-92.9	18.9
400	0.494	177.7	5.729	82.6	0.079	64.5	0.210	-99.6	16.6
500	0.487	172.5	4.642	77.2	0.094	65.6	0.204	-105.5	14.7
600	0.487	164.6	3.896	73.1	0.110	66.5	0.205	-110.0	13.2
700	0.503	159.6	3.382	68.7	0.127	66.0	0.210	-113.1	12.0
800	0.506	151.9	2.965	64.1	0.141	66.1	0.216	-116.1	10.9
900	0.512	148.2	2.667	60.5	0.159	65.2	0.221	-119.3	10.1
1000	0.525	142.8	2.384	56.6	0.174	64.7	0.228	-122.5	9.2
1200	0.544	133.5	2.069	50.4	0.205	62.8	0.245	-131.4	8.1
1400	0.555	124.4	1.773	42.8	0.232	61.1	0.273	-139.3	6.9
1600	0.579	117.7	1.578	36.7	0.264	59.3	0.307	-145.3	6.2
1800	0.587	110.0	1.434	31.1	0.293	55.8	0.332	-151.1	5.5
2000	0.617	101.6	1.310	26.5	0.322	53.5	0.353	-157.1	5.0