HEWLETT® PACKARD

Low Current, High Performance NPN Silicon Bipolar Transistor

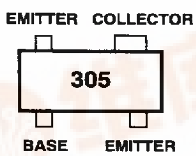
Technical Data

AT-30511
AT-30533

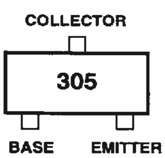
Features

- **High Performance Bipolar Transistor Optimized for Low Current, Low Voltage Operation**
- **900 MHz Performance:**
  AT-30511: 1.1 dB NF, 16 dB G_A
  AT-30533: 1.1 dB NF, 13 dB G_A
- **Characterized for End-Of-Life Battery Use (2.7 V)**
- **SOT-23 and SOT-143 SMT Plastic Packages**
- **Tape-And-Reel Packaging Option Available**[1]

Outline Drawing



SOT-143 (AT-30511)



SOT-23 (AT-30533)

Note:
1. Refer to "Tape-and-Reel Packaging for Semiconductor Devices".

Description

Hewlett-Packard's AT-30511 and AT-30533 are high performance NPN bipolar transistors that have been optimized for maximum f_T at low voltage operation, making them ideal for use in battery powered applications in wireless markets. The AT-30533 uses the 3 lead SOT-23, while the AT-30511 places the same die in the higher performance 4 lead SOT-143. Both packages are industry standard, and compatible with high volume surface mount assembly techniques.

The 3.2 micron emitter-to-emitter pitch and reduced parasitic design of these transistors yields extremely high performance products that can perform a multiplicity of tasks. The 5 emitter finger interdigitated geometry yields an extremely fast transistor with high gain and low operating currents.

Optimized performance at 2.7 V makes these devices ideal for use in 900 MHz, 1.8 GHz, and 2.4 GHz battery operated systems as an LNA, gain stage, buffer, oscillator, or active mixer. Typical amplifier designs at 900 MHz yield 1.3 dB noise figures with 13 dB or more associated gain at a 2.7 V, 1 mA bias. Voltage breakdowns are high enough for use at 5 volts. High gain capability at 1 V, 1 mA makes these devices a good fit for 900 MHz pager applications.

The AT-3 series bipolar transistors are fabricated using an optimized version of Hewlett- Packard's 10 GHz f_T, 30 GHz f_{MAX} Self-Aligned-Transistor (SAT) process. The die are nitride passivated for surface protection. Excellent device uniformity, performance and reliability are produced by the use of ion-implantation, self-alignment techniques, and gold metalization in the fabrication of these devices.

AT-30511, AT-30533 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum[1]
V_{EBO}	Emitter-Base Voltage	V	1.5
V_{CBO}	Collector-Base Voltage	V	11
V_{CEO}	Collector-Emitter Voltage	V	5.5
I_C	Collector Current	mA	8
P_T	Power Dissipation[2] [3]	mW	100
T_j	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Thermal Resistance[2]:
θ_{jc} = 550°C/W

Notes:
1. Operation of this device above any one of these parameters may cause permanent damage.
2. $T_{Mounting\ Surface}$ = 25°C.
3. Derate at 1.82 mW/°C for T_C > 95°C.

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions	Units	AT-30511 Min	AT-30511 Typ	AT-30511 Max	AT-30533 Min	AT-30533 Typ	AT-30533 Max
NF	Noise Figure V_{CE} = 2.7 V, I_C = 1 mA f = 0.9 GHz	dB		1.1[1]	1.4[1]		1.1[2]	1.4[2]
G_A	Associated Gain V_{CE} = 2.7 V, I_C = 1 mA f = 0.9 GHz	dB	14[1]	16[1]		11[2]	13[2]	
h_{FE}	Forward Current Transfer Ratio V_{CE} = 2.7 V, I_C = 1 mA	-	70		300	70		300
I_{CBO}	Collector Cutoff Current V_{CB} = 3 V	µA		0.03	0.2		0.03	0.2
I_{EBO}	Emitter Cutoff Current V_{EB} = 1 V	µA		0.1	1.5		0.1	1.5

Notes:
1. Test circuit B, Figure 1. Numbers reflect device performance de-embedded from circuit losses. Input loss = 0.4 dB; output loss = 0.4 dB.
2. Test circuit A, Figure 1. Numbers reflect device performance de-embedded from circuit losses. Input loss = 0.4 dB; output loss = 0.4 dB.

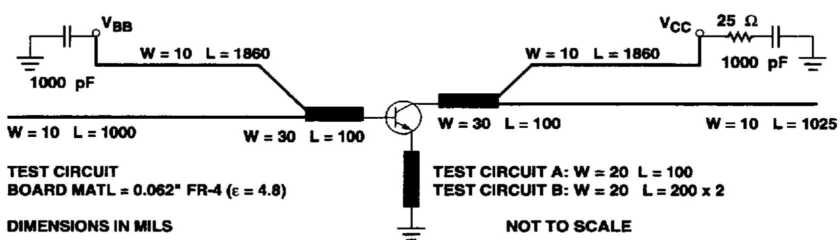


Figure 1. Test Circuit for Noise Figure and Associated Gain. This Circuit is a Compromise Match Between Best Noise Figure, Best Gain, Stability, a Practical, Synthesizable Match, and a Circuit Capable of Matching Both the AT-305 and AT-310 Geometries.

AT-30511, AT-30533 Characterization Information, T_A = 25°C

Symbol	Parameters and Test Conditions		Units	AT-30511	AT-30533
				Typ	Typ
P_{1dB}	Power at 1 dB Gain Compression (opt tuning) V_{CE} = 2.7 V, I_C = 5 mA	f = 0.9 GHz	dBm	7	7
G_{1dB}	Gain at 1 dB Gain Compression (opt tuning) V_{CE} = 2.7 V, I_C = 5 mA	f = 0.9 GHz	dB	16.5	15
IP_3	Output Third Order Intercept Point, V_{CE} = 2.7 V, I_C = 5 mA (opt tuning)	f = 0.9 GHz	dBm	17	17
$\|S_{21}\|_E^2$	Gain in 50 Ω System; V_{CE} = 2.7 V, I_C = 1 mA	f = 0.9 GHz	dB	10	9
C_{CB}	Collector-Base Capacitance	V_{CB} = 3V, f = 1 MHz	pF	0.04	0.04

Typical Performance

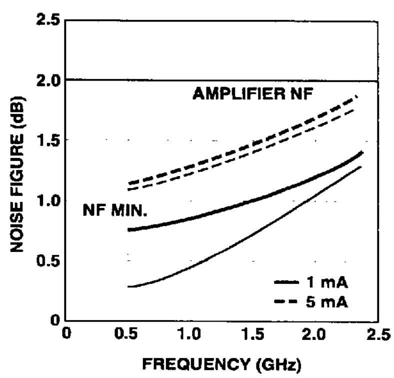


Figure 2. AT-30511 and AT-30533 Minimum Noise Figure and Amplifier NF[1] vs. Frequency and Current at V_{CE} = 2.7 V.

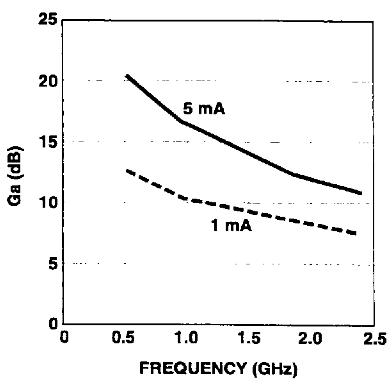


Figure 3. AT-30511 Associated Gain at Optimum Noise Match vs. Frequency and Current at V_{CE} = 2.7 V.

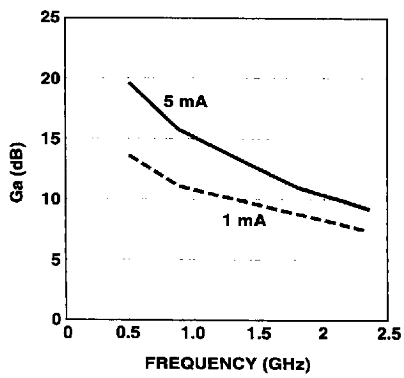


Figure 4. AT-30533 Associated Gain at Optimum Noise Match vs. Frequency and Current at V_{CE} = 2.7 V.

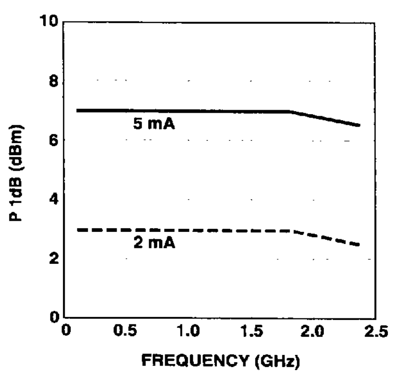


Figure 5. AT-30511 and AT-30533 Power at 1 dB Gain Compression vs. Frequency and Current at V_{CE} = 2.7 V.

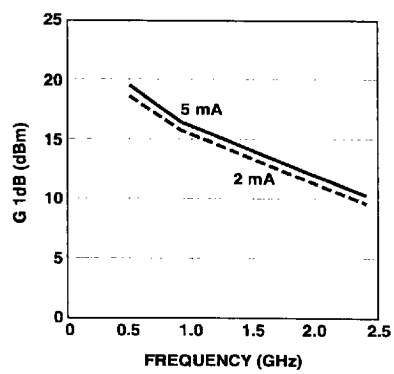


Figure 6. AT-30511 1 dB Compressed Gain vs. Frequency and Current at V_{CE} = 2.7 V.

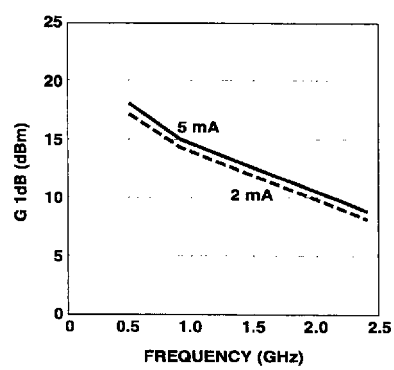


Figure 7. AT-30533 1 dB Compressed Gain vs. Frequency and Current at V_{CE} = 2.7 V.

Note:

1. Amplifier NF represents the noise figure which can be expected in a real circuit representing reasonable reflection coefficients and including circuit losses.

AT-30511, AT-30533 Typical Performance, continued

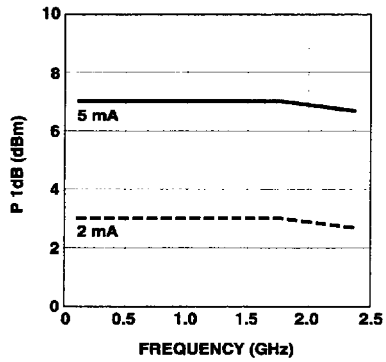


Figure 8. AT-30511 and AT-30533 Power at 1 dB Gain Compression vs. Frequency and Current at V_{CE} = 5 V.

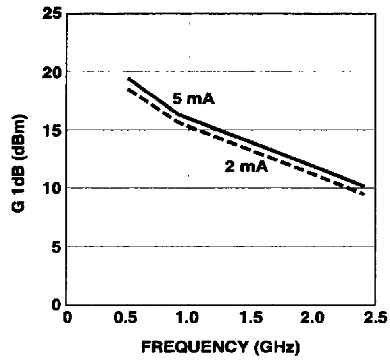


Figure 9. AT-30511 1 dB Compressed Gain vs. Frequency and Current at V_{CE} = 5 V.

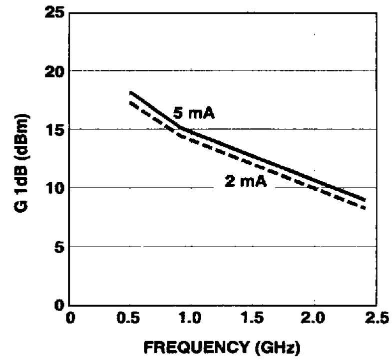


Figure 10. AT-30533 1 dB Compressed Gain vs. Frequency and Current at V_{CE} = 5 V.

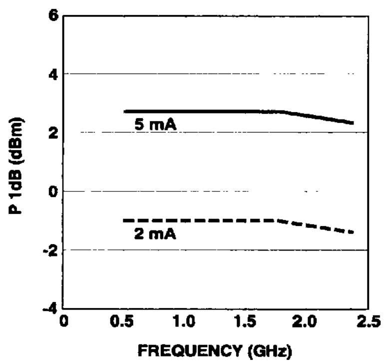


Figure 11. AT-30511 and AT-30533 Power at 1 dB Gain Compression vs. Frequency and Current at V_{CE} = 1 V.

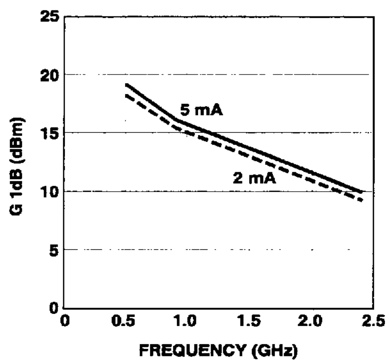


Figure 12. AT-30511 1 dB Compressed Gain vs. Frequency and Current at V_{CE} = 1 V.

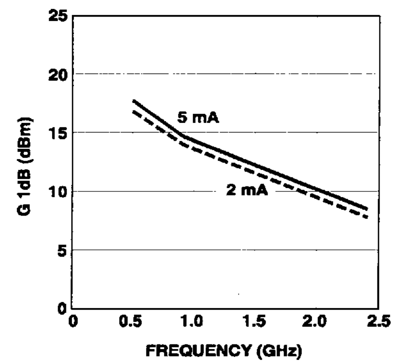


Figure 13. AT-30533 1 dB Compressed Gain vs. Frequency and Current at V_{CE} = 1 V.

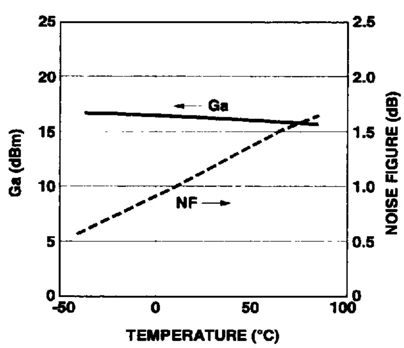


Figure 14. AT-30511 Noise Figure and Associated Gain at V_{CE} = 2.7 V, I_C = 1 mA vs. Temperature in Test Circuit, Figure 1. (Circuit Losses De-embedded)

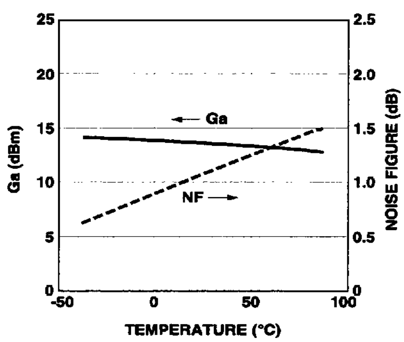


Figure 15. AT-30533 Noise Figure and Associated Gain at V_{CE} = 2.7 V, I_C = 1 mA vs. Temperature in Test Circuit, Figure 1. (Circuit Losses De-embedded)

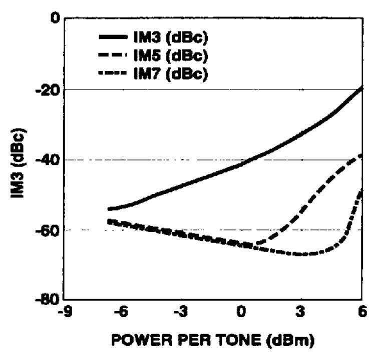


Figure 16. AT-30511 and AT-30533 Intermodulation Products vs. Output Power at V_{CE} = 2.7 V, I_C = 10 mA, 900 MHz with Optimal Tuning.

AT-30511 Typical Scattering Parameters, V_{CE} = 1 V, I_C = 1 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S11 Mag	S11 Ang	S21 dB	S21 Mag	S21 Ang	S12 dB	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.1	0.97	-5	10.84	3.48	175	-39.42	0.01	86	0.99	-2
0.5	0.95	-24	10.51	3.35	155	-25.87	0.05	72	0.95	-14
0.9	0.85	-42	9.96	3.15	137	-21.46	0.08	61	0.92	-24
1.0	0.83	-46	9.66	3.04	133	-20.71	0.09	58	0.91	-26
1.5	0.70	-67	8.71	2.73	113	-18.44	0.12	46	0.84	-36
1.8	0.63	-78	8.06	2.53	102	-17.69	0.13	41	0.80	-40
2.0	0.59	-85	7.75	2.44	96	-17.27	0.14	37	0.77	-43
2.4	0.50	-100	6.73	2.17	84	-16.79	0.14	32	0.73	-48
3.0	0.39	-122	5.58	1.90	67	-16.32	0.15	27	0.68	-53
4.0	0.29	-161	3.97	1.58	45	-15.87	0.16	20	0.63	-63
5.0	0.27	153	2.64	1.36	25	-15.47	0.17	20	0.61	-72

AT-30511 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 1 V, I_C = 1 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	0.3	0.96	10	1.49
0.9	0.4	0.92	19	1.33
1.8	0.9	0.83	43	0.98
2.4	1.3	0.76	60	0.74

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

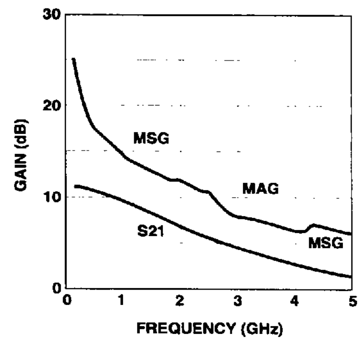


Figure 17. AT-30511 Gains vs. Frequency at V_{CE} = 1 V, I_C = 1 mA.

AT-30533 Typical Scattering Parameters, V_{CE} = 1 V, I_C = 1 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S11 Mag	S11 Ang	S21 dB	S21 Mag	S21 Ang	S12 dB	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.1	0.95	-5	10.90	3.51	174	-38.36	0.01	87	0.99	-3
0.5	0.91	-25	10.32	3.28	150	-25.08	0.06	73	0.95	-14
0.9	0.77	-41	9.44	2.97	128	-20.95	0.09	63	0.89	-24
1.0	0.73	-45	9.03	2.83	124	-20.21	0.10	61	0.88	-25
1.5	0.55	-62	7.75	2.44	102	-18.13	0.12	54	0.80	-33
1.8	0.46	-71	6.94	2.22	91	-17.33	0.14	51	0.77	-36
2.0	0.41	-76	6.51	2.12	85	-16.84	0.14	50	0.74	-38
2.4	0.30	-85	5.45	1.87	73	-16.05	0.16	49	0.71	-41
3.0	0.17	-95	4.26	1.63	57	-14.80	0.18	49	0.68	-46
4.0	0.02	-139	2.71	1.37	37	-12.58	0.24	48	0.65	-57
5.0	0.12	61	1.56	1.20	19	-10.14	0.31	45	0.62	-69

AT-30533 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 1 V, I_C = 1 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	0.3	0.94	7	1.02
0.9	0.4	0.89	16	0.86
1.8	0.9	0.75	43	0.58
2.4	1.3	0.65	65	0.38

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

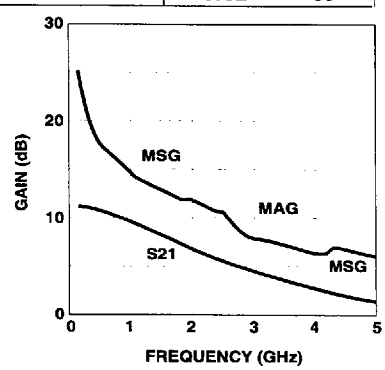


Figure 18. AT-30533 Gains vs. Frequency at V_{CE} = 2.7 V, I_C = 1 mA.

AT-30511 Typical Scattering Parameters, V_{CE} = 2.7 V, I_C = 1 mA, Common Emitter, Z_O = 50 Ω

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	0.97	-5	10.88	3.50	175	-40.13	0.01	86	0.999	-2
0.5	0.95	-23	10.58	3.38	156	-26.71	0.05	74	0.96	-13
0.9	0.86	-39	10.09	3.20	139	-22.28	0.08	63	0.93	-23
1.0	0.84	-43	9.83	3.10	135	-21.51	0.08	60	0.92	-25
1.5	0.72	-63	8.94	2.80	115	-19.15	0.11	49	0.85	-34
1.8	0.65	-73	8.32	2.60	105	-18.28	0.12	43	0.82	-38
2.0	0.61	-80	8.06	2.53	99	-17.83	0.13	40	0.79	-41
2.4	0.52	-93	7.06	2.25	86	-17.29	0.14	35	0.75	-46
3.0	0.41	-114	5.92	1.98	70	-16.72	0.15	30	0.70	-51
4.0	0.30	-150	4.35	1.65	48	-16.13	0.16	23	0.66	-61
5.0	0.26	165	3.06	1.42	28	-15.65	0.16	22	0.63	-69

AT-30511 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 2.7 V, I_C = 1 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT}		R_n
		Mag	Ang	
0.5[2]	0.3	0.96	10	1.49
0.9	0.4	0.92	19	1.33
1.8	0.9	0.83	43	0.98
2.4	1.3	0.76	60	0.74

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

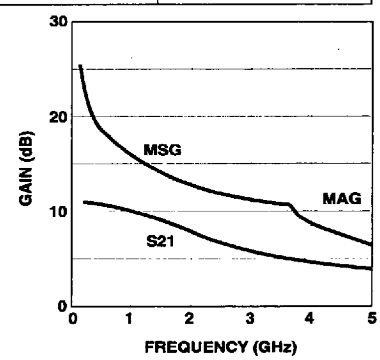


Figure 19. AT-30511 Gains vs. Frequency at V_{CE} = 2.7 V, I_C = 1 mA.

AT-30533 Typical Scattering Parameters, V_{CE} = 2.7 V, I_C = 1 mA, Common Emitter, Z_O = 50 Ω

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	0.95	-5	10.76	3.45	174	-39.49	0.01	87	0.999	-2
0.5	0.92	-23	10.21	3.24	151	-26.05	0.05	74	0.95	-13
0.9	0.78	-39	9.42	2.96	130	-21.78	0.08	64	0.91	-22
1.0	0.75	-42	9.04	2.83	126	-21.05	0.09	63	0.90	-23
1.5	0.58	-59	7.83	2.46	105	-18.88	0.11	55	0.83	-31
1.8	0.49	-66	7.04	2.25	94	-18.08	0.12	53	0.79	-34
2.0	0.44	-71	6.64	2.15	88	-17.58	0.13	52	0.77	-36
2.4	0.33	-79	5.59	1.90	76	-16.77	0.15	51	0.74	-39
3.0	0.21	-87	4.40	1.66	60	-15.50	0.17	51	0.71	-44
4.0	0.05	-88	2.87	1.39	40	-13.20	0.22	52	0.68	-54
5.0	0.09	47	1.72	1.22	22	-10.67	0.29	49	0.66	-66

AT-30533 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 2.7 V, I_C = 1 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT}		R_n
		Mag	Ang	
0.5[2]	0.3	0.94	7	1.02
0.9	0.4	0.89	16	0.88
1.8	0.9	0.75	43	0.58
2.4	1.3	0.65	65	0.38

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

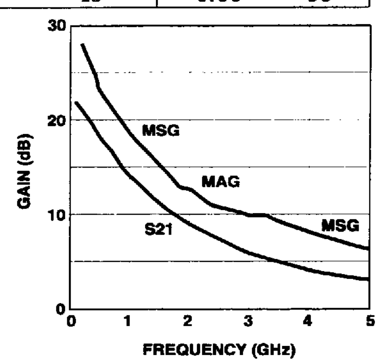


Figure 20. AT-30511- Gains vs. Frequency at V_{CE} = 2.7 V, I_C = 1 mA.

AT-30511 Typical Scattering Parameters, V_{CE} = 2.7 V, I_C = 5 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	0.88	-11	22.49	13.32	169	-40.50	0.01	83	0.97	-5
0.5	0.70	-48	20.42	10.49	134	-28.45	0.04	64	0.82	-22
0.9	0.49	-72	17.77	7.73	111	-25.24	0.05	57	0.70	-30
1.0	0.46	-77	17.09	7.15	107	-24.70	0.06	55	0.69	-31
1.5	0.30	-100	14.44	5.27	89	-22.62	0.07	53	0.62	-35
1.8	0.24	-112	13.10	4.52	81	-21.65	0.08	52	0.59	-37
2.0	0.21	-120	12.31	4.13	76	-21.05	0.09	52	0.58	-39
2.4	0.16	-140	10.94	3.52	67	-20.01	0.10	50	0.57	-42
3.0	0.13	-172	9.18	2.88	55	-18.55	0.12	48	0.55	-46
4.0	0.15	137	7.03	2.25	38	-16.57	0.15	44	0.53	-55
5.0	0.21	106	5.44	1.87	22	-14.88	0.18	39	0.52	-64

AT-30511 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 2.7 V, I_C = 5 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	1.1	0.77	9	1.10
0.9	1.2	0.71	18	0.96
1.8	1.5	0.60	45	0.66
2.4	1.8	0.51	65	0.47

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

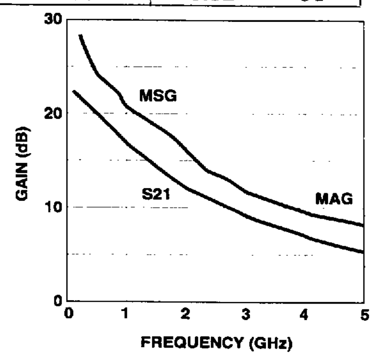


Figure 21. AT-30511 Gains vs. Frequency at V_{CE} = 2.7 V, I_C = 5 mA.

AT-30533 Typical Scattering Parameters, V_{CE} = 2.7 V, I_C = 5 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	0.84	-12	22.26	12.98	164	-39.96	0.01	82	0.98	-5
0.5	0.57	-39	18.54	8.46	121	-28.03	0.04	71	0.80	-18
0.9	0.37	-46	14.97	5.60	100	-24.09	0.06	70	0.73	-22
1.0	0.34	-46	14.20	5.13	96	-23.32	0.07	69	0.72	-22
1.5	0.23	-43	11.24	3.65	81	-20.30	0.10	68	0.69	-26
1.8	0.20	-38	9.85	3.11	73	-18.88	0.11	67	0.68	-28
2.0	0.19	-35	9.05	2.84	69	-18.02	0.13	66	0.68	-30
2.4	0.17	-27	7.70	2.43	61	-16.50	0.15	64	0.67	-33
3.0	0.15	-17	6.12	2.02	50	-14.57	0.19	61	0.66	-39
4.0	0.15	-2	4.30	1.64	34	-11.90	0.25	55	0.64	-49
5.0	0.17	11	3.07	1.42	19	-9.66	0.33	47	0.61	-61

AT-30533 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 2.7 V, I_C = 5 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	1.1	0.71	8	0.78
0.9	1.2	0.61	16	0.66
1.8	1.5	0.42	39	0.41
2.4	1.8	0.28	57	0.25

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

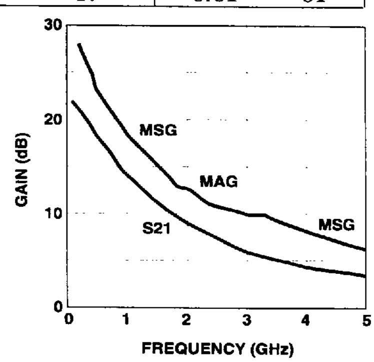


Figure 22. AT-30533 Gains vs. Frequency at V_{CE} = 2.7 V, I_C = 5 mA.

AT-30511 Typical Scattering Parameters, V_{CE} = 5 V, I_C = 1 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	0.98	-5	10.56	3.37	175	-40.34	0.01	87	0.999	-2
0.5	0.96	-21	10.30	3.27	157	-26.99	0.04	74	0.96	-13
0.9	0.88	-37	9.83	3.10	139	-22.52	0.07	64	0.93	-22
1.0	0.85	-41	9.57	3.01	136	-21.75	0.08	62	0.92	-24
1.5	0.74	-59	8.71	2.73	116	-19.23	0.11	51	0.86	-33
1.8	0.67	-69	8.13	2.55	106	-18.34	0.12	45	0.82	-38
2.0	0.63	-75	7.88	2.48	100	-17.85	0.13	42	0.80	-41
2.4	0.55	-88	6.90	2.21	87	-17.23	0.14	37	0.77	-45
3.0	0.43	-106	5.79	1.95	71	-16.53	0.15	31	0.72	-50
4.0	0.31	-138	4.29	1.64	49	-15.83	0.16	23	0.67	-60
5.0	0.25	178	3.04	1.42	29	-15.38	0.17	20	0.64	-69

AT-30511 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 5 V, I_C = 1 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	0.3	0.96	10	1.49
0.9	0.4	0.92	19	1.33
1.8	0.9	0.83	43	0.98
2.4	1.3	0.76	60	0.74

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

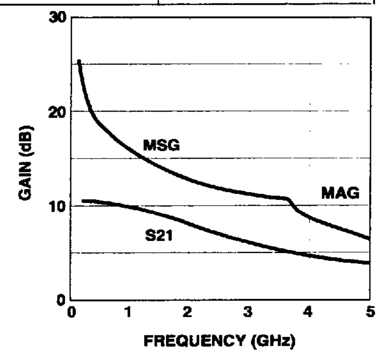


Figure 23. AT-30511 Gains vs. Frequency at V_{CE} = 5 V, I_C = 1 mA.

AT-30533 Typical Scattering Parameters, V_{CE} = 5 V, I_C = 1 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	0.96	-5	10.59	3.38	174	-39.38	0.01	85	0.999	-2
0.5	0.92	-22	10.07	3.19	151	-26.22	0.05	74	0.95	-13
0.9	0.79	-37	9.32	2.92	131	-21.99	0.08	65	0.91	-21
1.0	0.77	-41	8.94	2.80	127	-21.21	0.09	63	0.90	-23
1.5	0.60	-57	7.76	2.44	106	-19.02	0.11	56	0.83	-30
1.8	0.51	-64	7.01	2.24	95	-18.16	0.12	54	0.80	-33
2.0	0.46	-69	6.61	2.14	89	-17.66	0.13	52	0.78	-35
2.4	0.35	-76	5.59	1.90	77	-16.85	0.14	51	0.75	-39
3.0	0.23	-83	4.43	1.66	61	-15.58	0.17	51	0.72	-43
4.0	0.07	-85	2.92	1.40	41	-13.34	0.22	52	0.69	-53
5.0	0.07	38	1.79	1.23	23	-10.85	0.29	49	0.67	-65

AT-30533 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 5 V, I_C = 1 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	0.3	0.94	7	1.02
0.9	0.4	0.89	16	0.98
1.8	0.9	0.75	43	0.58
2.4	1.3	0.65	65	0.38

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{OPT}|$ values unachievable in physical circuits. See Figure 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

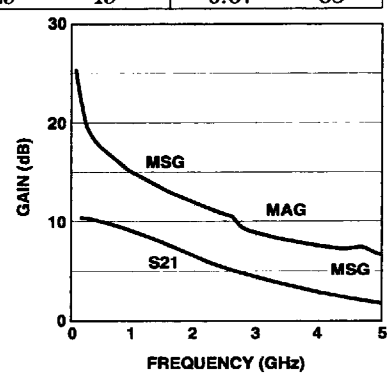


Figure 24. AT-30533 Gains vs. Frequency at V_{CE} = 5 V, I_C = 1 mA.

AT-30511 Typical Scattering Parameters, V_{CE} = 5 V, I_C = 5 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	0.90	-10	22.26	12.98	170	-40.75	0.01	82	0.97	-5
0.5	0.74	-43	20.41	10.49	136	-28.46	0.04	66	0.83	-22
0.9	0.53	-66	17.93	7.88	113	-25.18	0.06	58	0.72	-30
1.0	0.49	-70	17.28	7.31	109	-24.53	0.06	57	0.70	-31
1.5	0.33	-89	14.72	5.45	91	-22.46	0.08	54	0.63	-36
1.8	0.27	-99	13.41	4.68	83	-21.45	0.08	53	0.60	-38
2.0	0.24	-105	12.64	4.29	78	-20.87	0.09	52	0.59	-39
2.4	0.18	-120	11.27	3.66	69	-19.79	0.10	50	0.57	-42
3.0	0.12	-147	9.54	3.00	57	-18.34	0.12	48	0.55	-46
4.0	0.11	154	7.41	2.35	40	-16.45	0.15	43	0.53	-55
5.0	0.17	114	5.86	1.96	24	-14.84	0.18	38	0.52	-63

AT-30511 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 5 V, I_C = 5 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	1.1	0.77	9	1.10
0.9	1.2	0.71	18	0.96
1.8	1.5	0.60	45	0.66
2.4	1.8	0.51	65	0.47

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

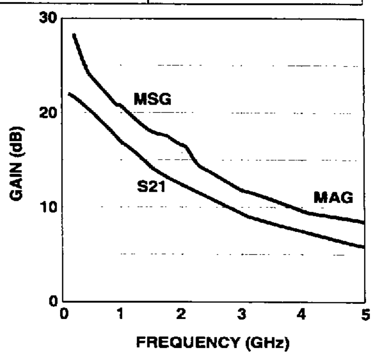


Figure 25. AT-30511 Gains vs. Frequency at V_{CE} = 5 V, I_C = 5 mA.

AT-30533 Typical Scattering Parameters, V_{CE} = 5 V, I_C = 5 mA, Common Emitter, Z_O = 50 Ω

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	0.86	-11	22.22	12.92	165	-40.16	0.01	83	0.98	-5
0.5	0.59	-37	18.69	8.60	122	-28.05	0.04	72	0.81	-18
0.9	0.40	-43	15.19	5.75	101	-24.14	0.06	70	0.74	-22
1.0	0.37	-43	14.43	5.27	97	-23.37	0.07	70	0.73	-22
1.5	0.27	-40	11.49	3.75	82	-20.30	0.10	68	0.70	-26
1.8	0.24	-37	10.11	3.20	75	-18.88	0.11	67	0.69	-28
2.0	0.23	-35	9.33	2.93	70	-18.05	0.13	66	0.68	-30
2.4	0.20	-30	7.97	2.50	62	-16.55	0.15	64	0.67	-33
3.0	0.18	-24	6.40	2.09	51	-14.64	0.19	61	0.66	-38
4.0	0.17	-14	4.58	1.70	36	-12.00	0.25	54	0.64	-49
5.0	0.16	-2	3.37	1.47	21	-9.83	0.32	46	0.61	-60

AT-30533 Typical Noise Parameters,

Common Emitter, Z_O = 50 Ω, 5 V, I_C = 5 mA

Freq GHz	F_{min}[1] dB	Γ_{OPT} Mag	Γ_{OPT} Ang	R_n
0.5[2]	1.1	0.71	8	0.78
0.9	1.2	0.61	16	0.66
1.8	1.5	0.42	39	0.41
2.4	1.8	0.28	57	0.25

Notes:
1. Matching constraints may make F_{min} values associated with high $|\Gamma_{opt}|$ values unachievable in physical circuits. See Fig. 2 for expected performance.
2. 0.5 GHz noise parameter values are extrapolated, not measured.

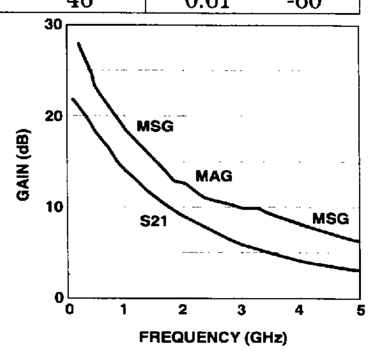


Figure 26. AT-30533 Gains vs. Frequency at V_{CE} = 5 V, I_C = 5 mA.

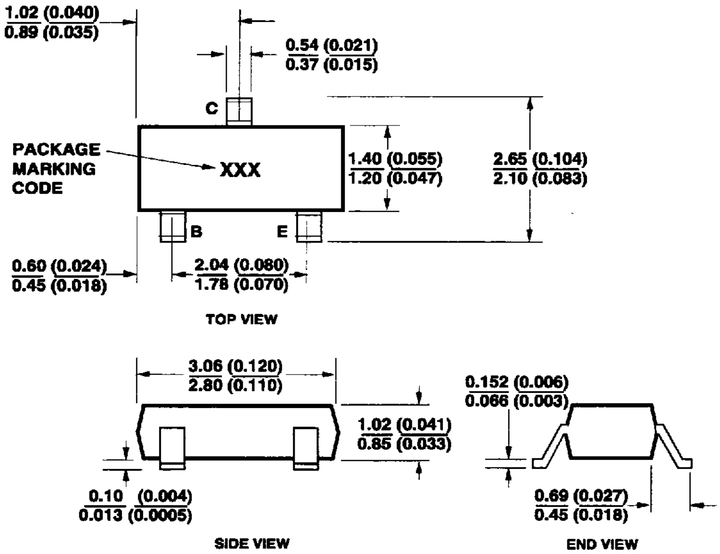
HEWLETT® PACKARD

Ordering Information

Part Number	Increment	Comments
AT-30511-BLK	100	Bulk
AT-30511-TR1	3000	7" Reel
AT-30533-BLK	100	Bulk
AT-30533-TR1	3000	7" Reel

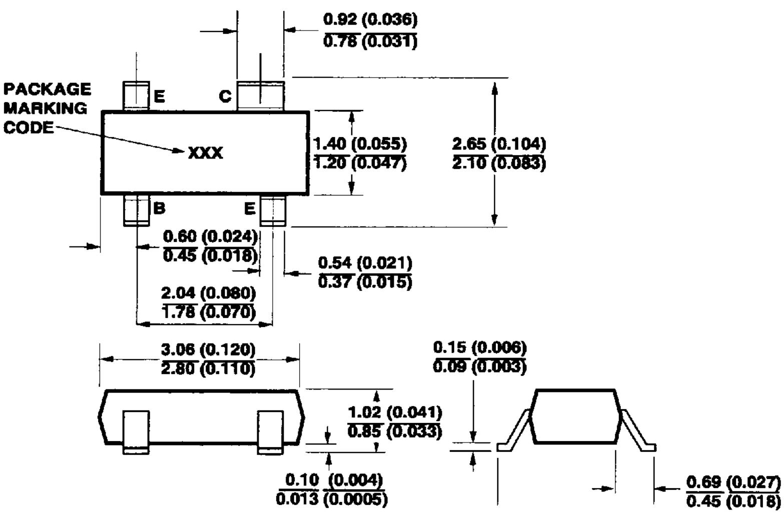
Package Dimensions

SOT-23 Plastic Package



DIMENSIONS ARE IN MILLIMETERS (INCHES)

SOT-143 Plastic Package



DIMENSIONS ARE IN MILLIMETERS (INCHES)

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