Up to 6 GHz Low Noise Silicon Bipolar Transistor

Technical Data

AT-41486

Features

- **Low Noise Figure:**
  1.4 dB Typical at 1.0 GHz
  1.7 dB Typical at 2.0 GHz
- **High Associated Gain:**
  18.0 dB Typical at 1.0 GHz
  13.0 dB Typical at 2.0 GHz
- **High Gain-Bandwidth Product:** 8.0 GHz Typical f_T
- **Surface Mount Plastic Package**
- **Tape-and-Reel Packaging Option Available[1]**

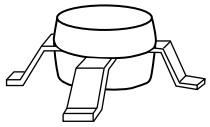
Note:
1. Refer to "Tape-and-Reel Packaging for Semiconductor Devices".

Description

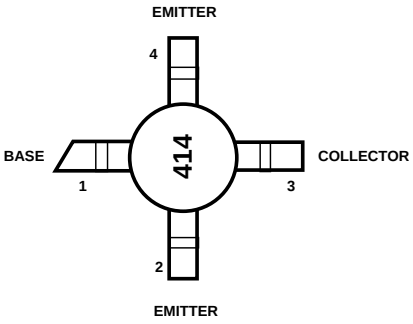
Hewlett-Packard's AT-41486 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-41486 is housed in a low cost surface mount .085" diameter plastic package. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 14 emitter finger interdigitated geometry yields an intermediate sized transistor with impedances that are easy to match for low noise and moderate power applications. Applications include use in wireless systems as an LNA, gain stage, buffer, oscillator, and mixer. An optimum noise match near 50 Ω at 900 MHz, makes this device easy to use as a low noise amplifier.

The AT-41486 bipolar transistor is fabricated using Hewlett-Packard's 10 GHz f_T Self-Aligned-Transistor (SAT) process. The die is 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 this device.

86 Plastic Package



Pin Connections



AT-41486 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum[1]
V_{EBO}	Emitter-Base Voltage	V	1.5
V_{CBO}	Collector-Base Voltage	V	20
V_{CEO}	Collector-Emitter Voltage	V	12
I_C	Collector Current	mA	60
P_T	Power Dissipation [2,3]	mW	500
T_j	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Thermal Resistance [2,4]:
θ_{jc} = 165°C/W

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 6 mW/°C for T_C > 68°C.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

Part Number Ordering Information

Part Number	Increment	Comments
AT-41486-TR1	1000	Reel
AT-41486-BLK	100	Bulk

Note: For more information, see "Tape and Reel Packaging for Semiconductor Devices".

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
$\|S_{21E}\|^2$	Insertion Power Gain; V_{CE} = 8 V, I_C = 25 mA	f = 1.0 GHz f = 2.0 GHz	dB		17.5 11.5	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression V_{CE} = 8 V, I_C = 25 mA	f = 2.0 GHz	dBm		18.0	
$G_{1\,dB}$	1 dB Compressed Gain; V_{CE} = 8 V, I_C = 25 mA	f = 2.0 GHz	dB		13.5	
NF_O	Optimum Noise Figure: V_{CE} = 8 V, I_C = 10 mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB		1.4 1.7 3.0	1.8
G_A	Gain @ NF_O; V_{CE} = 8 V, I_C = 10 mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB	17.0	18.0 13.0 9.0	
f_T	Gain Bandwidth Product: V_{CE} = 8 V, I_C = 25 mA		GHz		8.0	
h_{FE}	Forward Current Transfer Ratio; V_{CE} = 8 V, I_C = 10 mA		—	30	150	270
I_{CBO}	Collector Cutoff Current; V_{CB} = 8 V		μA			0.2
I_{EBO}	Emitter Cutoff Current; V_{EB} = 1 V		μA			1.0
C_{CB}	Collector Base Capacitance[1]: V_{CB} = 8 V, f = 1 MHz		pF		0.25	

Note:
1. For this test, the emitter is grounded.

AT-41486 Typical Performance, T_A = 25°C

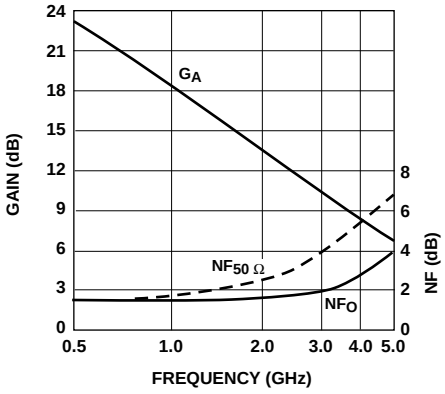


Figure 1. Noise Figure and Associated Gain vs. Frequency. V_{CE} = 8 V, I_C = 10 mA.

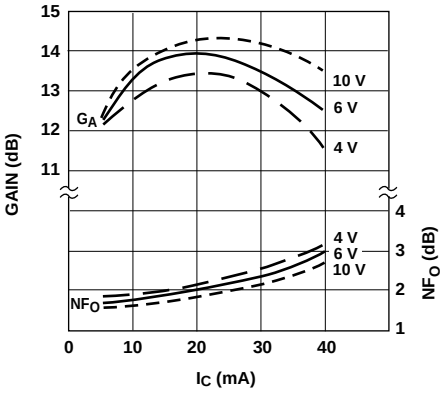


Figure 2. Optimum Noise Figure and Associated Gain vs. Collector Current and Collector Voltage. f = 2.0 GHz.

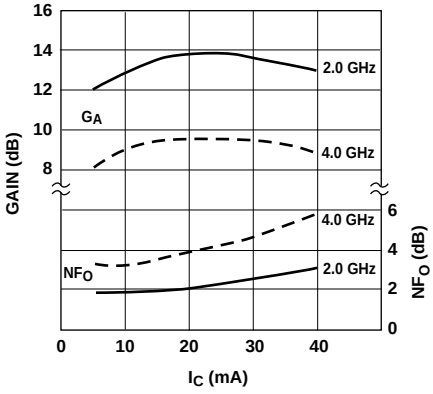


Figure 3. Optimum Noise Figure and Associated Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

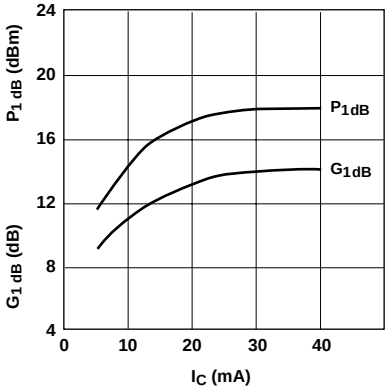


Figure 4. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency. V_{CE} = 8 V, f = 2.0 GHz.

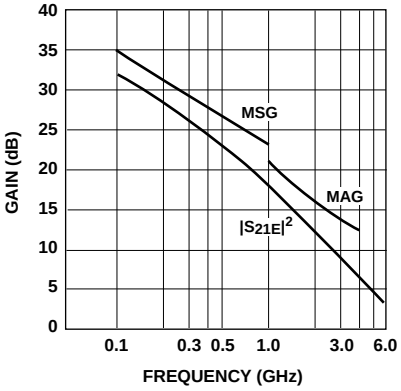


Figure 5. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{CE} = 8 V, I_C = 25 mA.

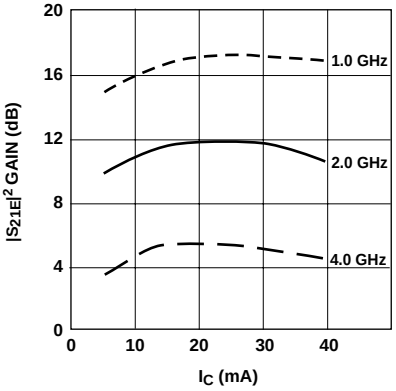


Figure 6. Insertion Power Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

AT-41486 Typical Scattering Parameters, Common Emitter,

Z_O = 50 Ω, T_A = 25°C, V_{CE} = 8 V, I_C = 10 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.1	.74	-38	28.1	25.46	157	-39.6	.011	68	.94	-12
0.5	.59	-127	22.0	12.63	107	-30.2	.031	47	.60	-29
1.0	.56	-168	16.8	6.92	84	-27.7	.041	46	.49	-29
1.5	.57	169	13.5	4.72	69	-26.2	.049	49	.45	-32
2.0	.62	152	11.1	3.61	56	-24.8	.058	43	.42	-39
2.5	.63	142	9.3	2.91	47	-23.4	.068	52	.40	-42
3.0	.64	130	7.6	2.41	37	-22.2	.078	52	.39	-50
3.5	.68	122	6.3	2.06	26	-20.6	.093	51	.37	-60
4.0	.71	113	5.1	1.80	16	-19.5	.106	48	.35	-70
4.5	.74	105	4.0	1.59	7	-18.0	.125	48	.35	-84
5.0	.77	99	3.1	1.42	-4	-17.2	.139	43	.35	-98
5.5	.79	93	2.0	1.27	-13	-16.3	.153	38	.35	-114
6.0	.81	87	1.1	1.13	-22	-15.4	.170	34	.35	-131

AT-41486 Typical Scattering Parameters,

Common Emitter, Z_O = 50 Ω, T_A = 25°C, V_{CE} = 8 V, I_C = 25 mA

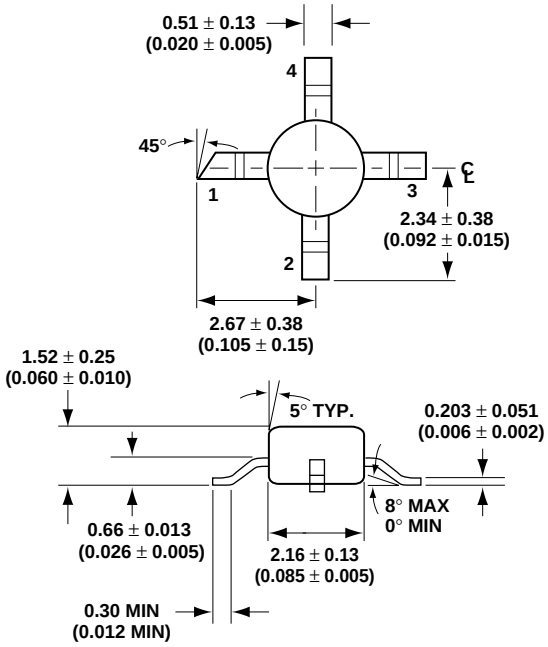
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.1	.50	-75	32.0	40.01	142	-41.3	.009	54	.85	-17
0.5	.55	-158	23.2	14.38	97	-34.1	.020	48	.51	-24
1.0	.57	177	17.5	7.50	78	-29.9	.032	61	.46	-24
1.5	.57	161	14.1	5.07	65	-27.3	.043	62	.44	-28
2.0	.59	148	11.5	3.75	53	-24.8	.058	59	.43	-35
2.5	.61	139	9.6	3.02	45	-22.9	.072	58	.40	-41
3.0	.65	128	8.0	2.52	34	-21.6	.083	57	.38	-49
3.5	.70	121	6.7	2.17	24	-20.1	.099	56	.36	-59
4.0	.74	113	5.7	1.92	14	-18.8	.115	52	.34	-72
4.5	.78	107	4.7	1.72	3	-17.6	.132	47	.32	-87
5.0	.78	102	3.7	1.53	-8	-16.6	.149	42	.31	-106
5.5	.78	96	2.7	1.36	-19	-15.4	.169	36	.31	-125
6.0	.76	91	1.6	1.21	-29	-14.5	.188	31	.33	-144

A model for this device is available in the DEVICE MODELS section.

AT-41486 Noise Parameters: V_{CE} = 8 V, I_C = 10 mA

Freq.	NF_O	Γ_{opt}		$R_N/50$
GHz	dB	Mag	Ang	
0.1	1.3	.12	3	0.17
0.5	1.3	.10	16	0.17
1.0	1.4	.04	43	0.16
2.0	1.7	.12	-145	0.16
4.0	3.0	.44	-99	0.40

86 Plastic Package Dimensions



DIMENSIONS ARE IN MILLIMETERS (INCHES)

Modification: All legs have been lengthened to facilitate mounting to a microstrip circuit, especially the emitter legs which must be threaded through drilled holes to be soldered onto the substrate backside (groundplane).

www.hp.com/go/rf

For technical assistance or the location of your nearest Hewlett-Packard sales office, distributor or representative call:

Americas/Canada: 1-800-235-0312 or 408-654-8675

Far East/Australasia: Call your local HP sales office.

Japan: (81 3) 3335-8152

Europe: Call your local HP sales office.

Data subject to change.

Obsoletes 5965-8928E

596?-????E (9/98)