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AT-41500
Up to 6 GHz Low Noise Silicon Bipolar Transistor Chip

Data Sheet

Description/Applications

The AT-41500 of Avago Techologies is a general purpose NPN bipolar transistor chip that offers excellent high frequency performance. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 15 emitter fingers interdigitated geometry yields an intermediate sized transistor with impedances that are easy to match for low noise and moderate power applications. This device is designed for use in low noise, wideband amplifier, mixer and oscillator applications in the VHF, UHF, and microwave frequencies. An optimum noise match near 50 Ω at 1GHz, makes this device easy to use as a low noise amplifier.

The AT-41500 bipolar transistor is fabricated using Avago Technologies' 10 GHz fT 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 metallization in the fabrication of this device.

Features

Performance in 86 plastic package:

- Low Noise Figure
  1.4 dB typical at 1 GHz
  1.7 dB typical at 2 GHz
- High Associated Gain
  17.0 dB typical at 1GHz
  12.5 dB typical at 2 GHz
- High Gain-Bandwidth Product
  8.0 GHz typical f_T

Chip Outline

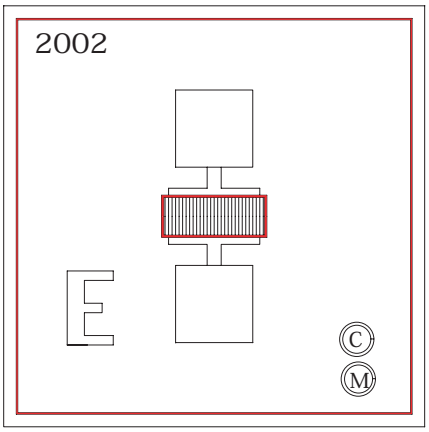


Table 1. Absolute Maximum Ratings [1]

Symbol	Parameter	Unit	Max Rating
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	200
T_{STG}	Storage Temperature	°C	-60 to 200
θjc	Thermal Resistance [2, 4]	°C/W	95

Notes:
1. Operation in excess of any one of these conditions may result in permanent damage to the device.
2. $T_{—MOUNTING\ SURFACE} = 25\ ^{\circ}C$
3. Derate at 10.5 mW/°C for $T_{—MOUNTING\ SURFACE} > 153\ ^{\circ}C$.
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do the alternate method.

Table 2. Electrical Specifications at $T_A = +25^{\circ}C$, V_{CE}=8V

Symbol	Parameter and Test Condition		Units	Min.	Typ.	Max.
NFo	Optimum Noise Figure: Ic = 10 mA	f = 1.0 GHz	dB		1.40	
		f = 2.0 GHz	dB		1.70	
		f = 4.0 GHz	dB		3.00	
GA	Gain @ NFo ; Ic=10mA	f = 1.0 GHz	dB		17.0	
		f = 2.0 GHz	dB		12.5	
		f = 4.0 GHz	dB		8.0	
$\|S_{21E}\|^2$	Insertion Power Gain : Ic = 25 mA	f = 1.0 GHz	dB		17.0	
		f = 2.0 GHz	dB		11.0	
P1dB	Power Output @1dB Gain Compression:Ic=25 mA	f = 2.0 GHz	dBm		18.0	
G1dB	1 dB Compressed Gain: Ic = 25 mA	f = 2.0 GHz	dB		13.0	
f_T	Gain Bandwidth Product: Ic = 25 mA		GHz		8.0	
h_{FE}	Forward Current Transfer Ratio: Ic = 10 mA			30	150	270
I_{CBO}	Collector Cutoff Current: VCB = 8 V		uA			0.2
I_{EBO}	Emitter Cutoff Current: VEB = 1 V		uA			1

Notes:
1. RF performance is determined by packaging and testing 10 devices per wafer.
2. RF performance is measured in 86 plastic packages.

Typical Performance Curves at Tc = +25°C

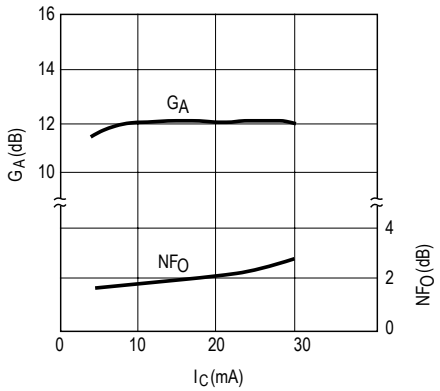


Figure 2. AT-41586 Optimum Noise Figure and Associated Gain vs. Collector Current at VCE = 8 V, f = 2.0 GHz.

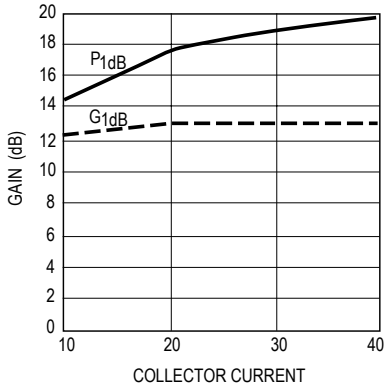


Figure 3. AT-41586 P1dB and G1dB vs. Collector Current at VCE = 8 V, f = 2.0 GHz.

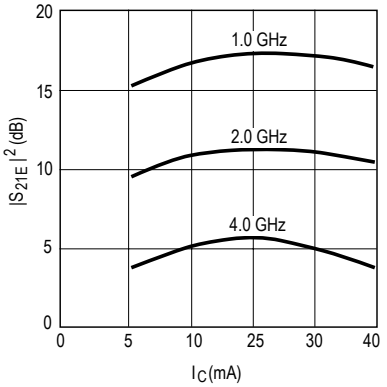


Figure 4. AT-41586 Insertion Power Gain vs. Collector Current and Frequency at 25°C, VCE = 8 V.

Typical Scattering Parameters at Tc = +25°C

V_{CE}=8V, Ic = 10mA, Zo=50 Ohm

Freq.	S11		S21		S12		S22	
GHz	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.1	0.71	-31.07	25.05	162.68	0.01	76.37	0.93	-9.41
0.3	0.67	-80.52	19.56	135.82	0.02	57.2	0.78	-21.46
0.5	0.64	-111.27	14.66	119.68	0.03	48.47	0.66	-25.21
0.7	0.62	-130.51	11.39	109.6	0.03	45.46	0.58	-25.54
0.9	0.61	-143.51	9.21	102.62	0.03	45.15	0.54	-24.99
1.1	0.61	-153.01	7.7	97.33	0.04	46.1	0.51	-24.42
1.3	0.61	-160.38	6.59	93.05	0.04	47.6	0.49	-24.07
1.5	0.61	-166.4	5.76	89.4	0.04	49.3	0.48	-23.97
1.7	0.61	-171.49	5.11	86.19	0.04	51.03	0.48	-24.11
1.9	0.61	-175.93	4.59	83.27	0.05	52.69	0.47	-24.44
2.1	0.61	-179.89	4.17	80.58	0.05	54.22	0.47	-24.94
2.3	0.61	176.52	3.81	78.06	0.05	55.63	0.46	-25.56
2.5	0.61	173.2	3.51	75.68	0.06	56.9	0.46	-26.29
2.7	0.61	170.11	3.26	73.4	0.06	58.03	0.46	-27.11
2.9	0.62	167.21	3.04	71.21	0.06	59.03	0.46	-28.01
3.1	0.62	164.46	2.84	69.09	0.07	59.92	0.46	-28.96
3.3	0.62	161.83	2.67	67.03	0.07	60.7	0.46	-29.97
3.5	0.62	159.32	2.52	65.04	0.07	61.38	0.46	-31.01
3.7	0.63	156.9	2.39	63.09	0.08	61.98	0.46	-32.1
3.9	0.63	154.56	2.27	61.18	0.08	62.49	0.46	-33.22
4.1	0.63	152.3	2.16	59.32	0.08	62.93	0.46	-34.37
4.3	0.63	150.11	2.06	57.5	0.09	63.3	0.46	-35.54
4.5	0.64	147.98	1.96	55.71	0.09	63.61	0.46	-36.74
4.7	0.64	145.91	1.88	53.95	0.09	63.86	0.46	-37.95
4.9	0.64	143.89	1.8	52.23	0.1	64.06	0.46	-39.19
5.1	0.65	141.92	1.73	50.54	0.1	64.22	0.46	-40.43
5.3	0.65	139.99	1.67	48.88	0.1	64.33	0.46	-41.69
5.5	0.66	138.11	1.61	47.24	0.11	64.41	0.46	-42.97
5.7	0.66	136.27	1.55	45.64	0.11	64.44	0.46	-44.25
5.9	0.66	134.47	1.49	44.06	0.12	64.45	0.46	-45.55
6	0.66	133.58	1.47	43.29	0.12	64.44	0.46	-46.2

Typical Noise Parameters at Tc = +25°C

V_{CE}=8V, Ic = 10mA, Zo=50 Ohm

Freq GHz	Nfo dB	Spot		Rn/50
		Mag	Ang	
0.1	1.20	0.12	3	0.17
0.5	1.20	0.10	16	0.17
1.0	1.30	0.06	27	0.16
2.0	1.59	0.24	163	0.16

Typical Scattering Parameters at Tc = +25°C

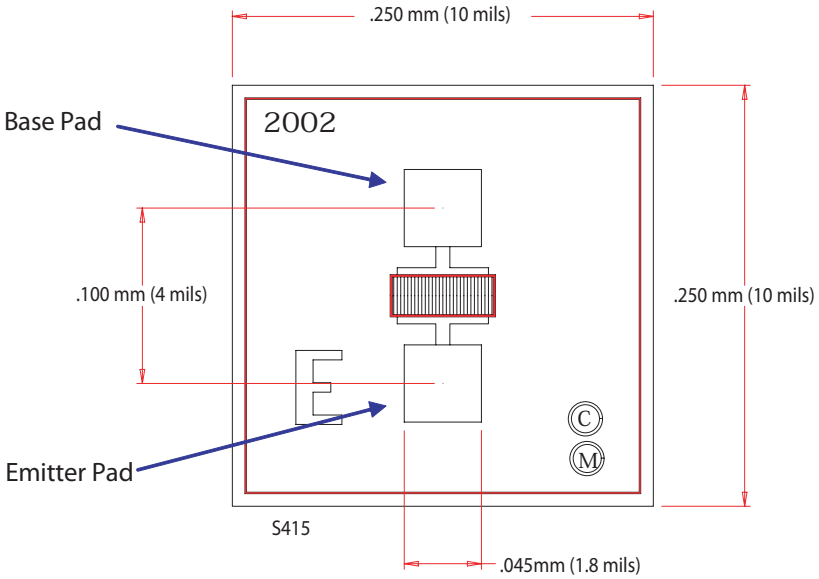
V_{CE}=8V, Ic = 25mA, Zo=50 Ohm

Freq.	S11		S21		S12		S22	
GHz	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.1	0.45	-56.86	37.18	155.62	0.01	71.88	0.86	-13.32
0.3	0.54	-117.7	24.66	124.86	0.02	55.41	0.65	-24.66
0.5	0.57	-142.6	16.94	110.36	0.02	53.11	0.53	-24.96
0.7	0.59	-155.82	12.65	102.12	0.02	55.08	0.48	-23.39
0.9	0.59	-164.33	10.04	96.54	0.02	57.9	0.46	-22.09
1.1	0.6	-170.54	8.3	92.29	0.03	60.58	0.44	-21.34
1.3	0.6	-175.45	7.06	88.79	0.03	62.86	0.43	-21.05
1.5	0.6	-179.56	6.14	85.76	0.04	64.73	0.43	-21.12
1.7	0.6	176.85	5.44	83.04	0.04	66.24	0.42	-21.46
1.9	0.61	173.62	4.87	80.54	0.04	67.44	0.42	-21.99
2.1	0.61	170.67	4.42	78.19	0.05	68.39	0.42	-22.68
2.3	0.61	167.91	4.04	75.97	0.05	69.13	0.42	-23.49
2.5	0.61	165.31	3.72	73.84	0.05	69.71	0.42	-24.39
2.7	0.62	162.84	3.44	71.78	0.06	70.14	0.42	-25.37
2.9	0.62	160.47	3.21	69.79	0.06	70.47	0.42	-26.4
3.1	0.62	158.19	3	67.85	0.07	70.69	0.42	-27.49
3.3	0.62	155.98	2.82	65.96	0.07	70.84	0.41	-28.61
3.5	0.63	153.84	2.66	64.11	0.07	70.91	0.41	-29.77
3.7	0.63	151.75	2.52	62.3	0.08	70.93	0.41	-30.96
3.9	0.63	149.72	2.39	60.52	0.08	70.89	0.42	-32.17
4.1	0.63	147.74	2.27	58.77	0.09	70.81	0.42	-33.41
4.3	0.64	145.79	2.17	57.05	0.09	70.7	0.42	-34.66
4.5	0.64	143.89	2.07	55.37	0.09	70.54	0.42	-35.93
4.7	0.64	142.03	1.98	53.7	0.1	70.36	0.42	-37.21
4.9	0.65	140.21	1.9	52.07	0.1	70.15	0.42	-38.51
5.1	0.65	138.42	1.83	50.46	0.11	69.92	0.42	-39.82
5.3	0.65	136.66	1.76	48.87	0.11	69.66	0.42	-41.13
5.5	0.66	134.93	1.69	47.31	0.11	69.39	0.42	-42.46
5.7	0.66	133.24	1.63	45.77	0.12	69.1	0.42	-43.79
5.9	0.66	131.57	1.58	44.26	0.12	68.79	0.42	-45.13
6	0.67	130.75	1.55	43.51	0.12	68.63	0.42	-45.8

Part Number Ordering Information

Part number	Devices Per Tray
AT-41500-GP4	100

AT-41500 Chip Dimensions



Note : Die Thickness is 5 ~ 6 mils

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

AV02-1844EN - March 26, 2009