Agilent Technologies
Innovating the HP Way

Up to 6 GHz Medium Power Silicon Bipolar Transistor

Technical Data

AT-42086

Features

- **High Output Power:** 20.5 dBm Typical $P_{1\ dB}$ at 2.0 GHz
- **High Gain at 1 dB Compression:** 13.5 dB Typical $G_{1\ dB}$ at 2.0 GHz
- **Low Noise Figure:** 1.9 dB Typical NF_O 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]**

Description

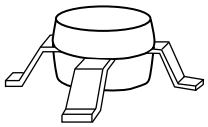
Agilent's AT-42086 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-42086 is housed in a low cost surface mount .085" diameter plastic package. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 20 emitter finger interdigitated geometry yields a medium sized transistor with impedances that are easy to match for low noise and medium power applications. Applications include use in wireless systems as an LNA, gain stage, buffer, oscillator, and mixer. An optimum noise match near 50 Ω up to 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-42086 bipolar transistor is fabricated using Agilent'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.

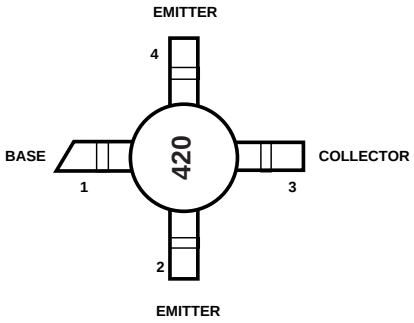
Note:

1. Refer to PACKAGING section "Tape-and-Reel Packaging for Semiconductor Devices."

86 Plastic Package



Pin Connections



AT-42086 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	80
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} = 140°C/W

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 7.1 mW/°C for T_C > 80°C.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

Part Number Ordering Information

Part Number	Increment	Comments
AT-42086-BLK	100	Bulk
AT-42086-TR1	1000	Reel

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 = 35 mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB	15.0	16.5 10.5 4.5	
$P_{1\ dB}$	Power Output @ 1 dB Gain Compression V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz f= 4.0 GHz	dBm		20.5 20.0	
$G_{1\ dB}$	1 dB Compressed Gain; V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz f = 4.0 GHz	dB		13.5 9.0	
NF_O	Optimum Noise Figure: V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz f = 4.0 GHz	dB		1.9 3.5	
G_A	Gain @ NF_O; V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz f = 4.0 GHz	dB		13.0 9.0	
f_T	Gain Bandwidth Product: V_{CE} = 8 V, I_C = 35 mA		GHz		8.0	
h_{FE}	Forward Current Transfer Ratio; V_{CE} = 8 V, I_C = 35 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			2.0
C_{CB}	Collector Base Capacitance[1]: V_{CB} = 8 V, f = 1 MHz		pF		0.32	

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

AT-42086 Typical Performance, T_A = 25°C

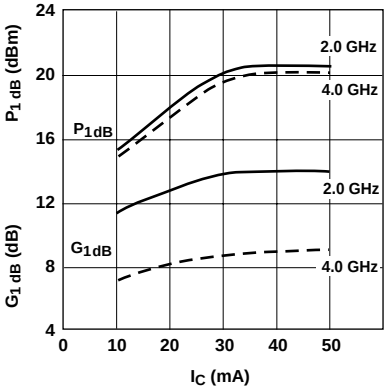


Figure 1. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

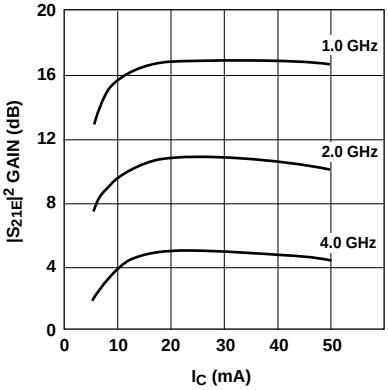


Figure 2. Insertion Power Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

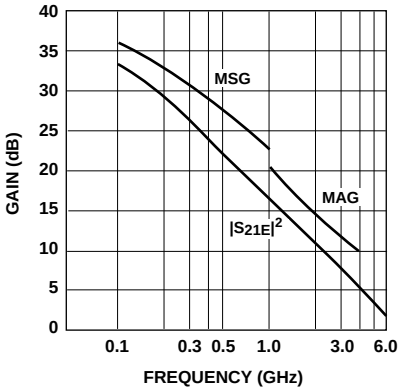


Figure 3. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{CE} = 8 V, I_C = 35 mA.

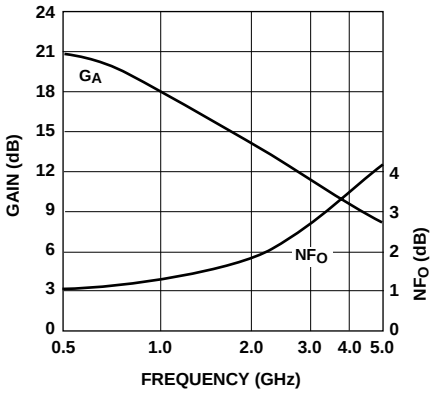


Figure 4. Noise Figure and Associated Gain vs. Frequency. V_{CE} = 8 V, I_C = 10 mA.

AT-42086 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	.68	-48	28.0	25.12	153	-36.0	.016	65	.91	-15
0.5	.63	-141	20.9	11.07	102	-29.9	.032	42	.54	-30
1.0	.63	-176	15.4	5.87	80	-27.4	.043	43	.43	-30
1.5	.65	164	12.0	3.98	65	-26.0	.050	46	.40	-34
2.0	.66	151	9.5	2.99	53	-23.9	.064	52	.38	-40
2.5	.69	142	7.8	2.44	45	-23.1	.070	53	.36	-46
3.0	.71	132	6.2	2.04	34	-21.6	.084	54	.34	-54
3.5	.73	123	4.8	1.74	24	-19.7	.104	53	.33	-67
4.0	.75	115	3.6	1.51	14	-18.3	.122	51	.30	-80
4.5	.78	108	2.6	1.34	5	-17.2	.138	50	.31	-94
5.0	.80	101	1.6	1.20	-4	-16.0	.159	46	.31	-110
5.5	.82	95	0.6	1.08	-12	-14.8	.182	40	.32	-129
6.0	.85	89	-0.2	0.97	-21	-14.0	.200	35	.34	-148

AT-42086 Typical Scattering Parameters,

Common Emitter, Z_O = 50 Ω, T_A = 25°C, V_{CE} = 8 V, I_C = 35 mA

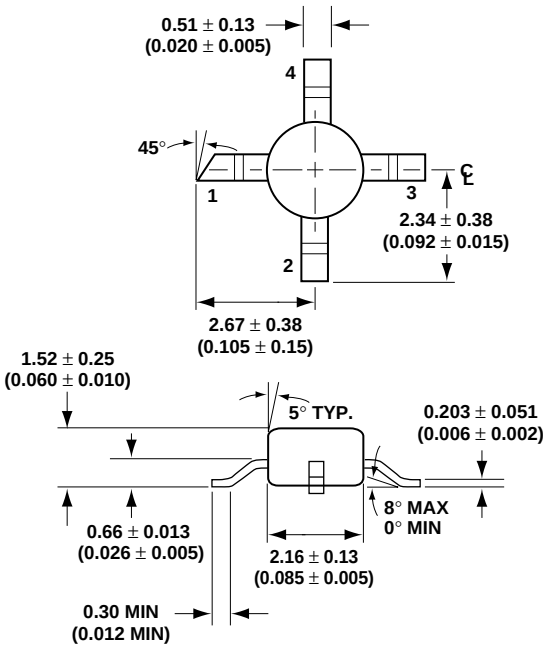
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.1	.48	-94	32.8	43.62	137	-37.7	.013	65	.77	-25
0.5	.57	-168	22.4	13.21	92	-32.6	.023	57	.39	-28
1.0	.59	168	16.5	6.69	75	-28.7	.037	62	.33	-27
1.5	.61	154	13.0	4.48	62	-24.8	.057	64	.31	-31
2.0	.63	143	10.5	3.36	51	-23.0	.071	61	.29	-37
2.5	.68	137	8.7	2.72	43	-21.0	.089	56	.26	-45
3.0	.68	127	7.0	2.25	33	-19.7	.104	58	.25	-53
3.5	.71	118	5.7	1.92	24	-18.4	.121	55	.24	-65
4.0	.73	111	4.5	1.69	14	-17.3	.136	49	.20	-80
4.5	.76	104	3.5	1.49	5	-15.9	.161	46	.21	-95
5.0	.78	98	2.4	1.32	-3	-15.2	.174	43	.21	-115
5.5	.81	91	1.6	1.20	-12	-14.3	.193	36	.22	-136
6.0	.84	85	0.7	1.08	-20	-13.4	.213	31	.25	-156

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

AT-42086 Noise Parameters: V_{CE} = 8 V, I_C = 10 mA

Freq.	NF_O	Γ_{opt}		$R_N/50$
GHz	dB	Mag	Ang	
0.1	1.0	.04	8	0.13
0.5	1.1	.03	62	0.12
1.0	1.5	.06	168	0.12
2.0	1.9	.25	-146	0.12
4.0	3.5	.58	-100	0.52

86 Plastic Package Dimensions



DIMENSIONS ARE IN MILLIMETERS (INCHES)

Agilent Technologies
Innovating the HP Way

www.semiconductor.agilent.com

Data subject to change.

5965-8914E (11/99)