Agilent Technologies
Innovating the HP Way

Up to 6 GHz Low Noise Silicon Bipolar Transistor

Technical Data

AT-41435

Features

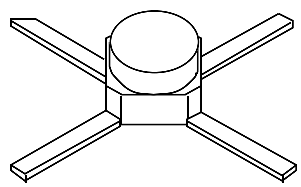
- **Low Noise Figure:**
  1.7 dB Typical at 2.0 GHz
  3.0 dB Typical at 4.0 GHz
- **High Associated Gain:**
  14.0 dB Typical at 2.0 GHz
  10.0 dB Typical at 4.0 GHz
- **High Gain-Bandwidth Product:** 8.0 GHz Typical f_T
- **Cost Effective Ceramic Microstrip Package**

Description

Agilent's AT-41435 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-41435 is housed in a cost effective surface mount 100 mil micro-X 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. 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 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-41435 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.

35 micro-X Package



AT-41435 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	200
T_{STG}	Storage Temperature[4]	°C	-65 to 200

Thermal Resistance [2,5]:
θ_{jc} = 200°C/W

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 5 mW/°C for T_C > 100°C.
4. Storage above +150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200°C.
5. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See MEASUREMENTS section "Thermal Resistance" for more information.

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 = 2.0 GHz f = 4.0 GHz	dB		11.5 6.0	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression V_{CE} = 8 V, I_C = 25 mA	f = 2.0 GHz f = 4.0 GHz	dBm		19.0 18.5	
$G_{1\,dB}$	1 dB Compressed Gain; V_{CE} = 8 V, I_C = 25 mA	f = 2.0 GHz f = 4.0 GHz	dB		14.0 9.5	
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		1.3 1.7 3.0	 2.0
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	 13.0 	18.5 14.0 10.0	
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		0.2	

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

AT-41435 Typical Performance, $T_A = 25°C$

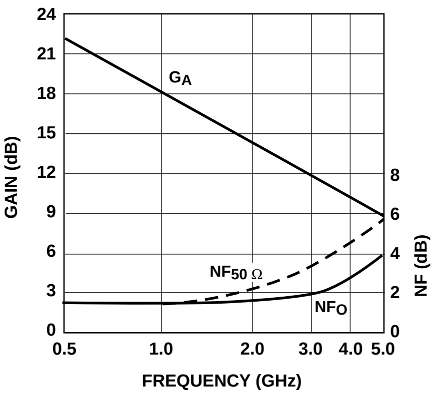


Figure 1. Noise Figure and Associated Gain vs. Frequency. V_{CE} = 8 V, I_C = 10 mA.

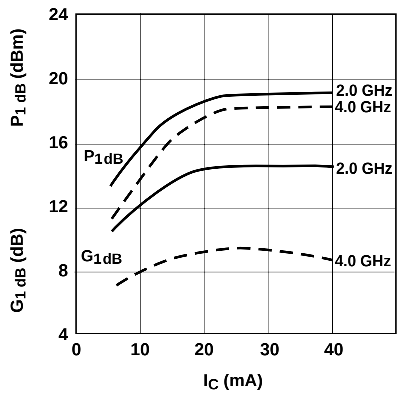


Figure 2. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

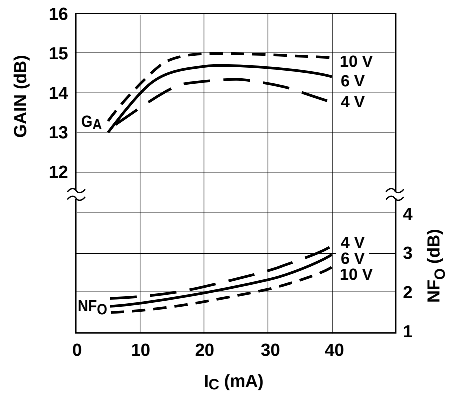


Figure 3. Optimum Noise Figure and Associated Gain vs. Collector Current and Collector Voltage. f = 2.0 GHz.

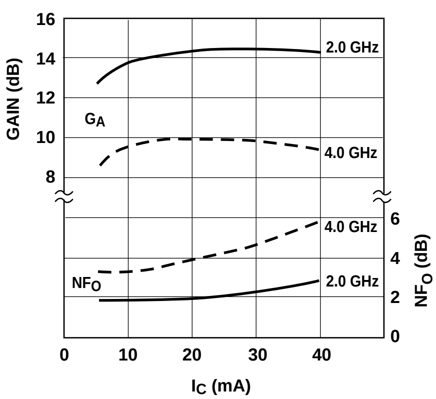


Figure 4. Optimum Noise Figure and Associated Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

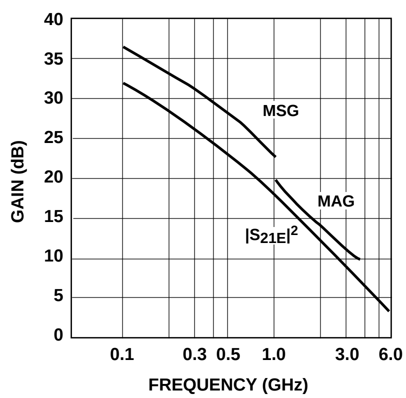


Figure 5. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{CE} = 8 V, I_C = 25 mA.

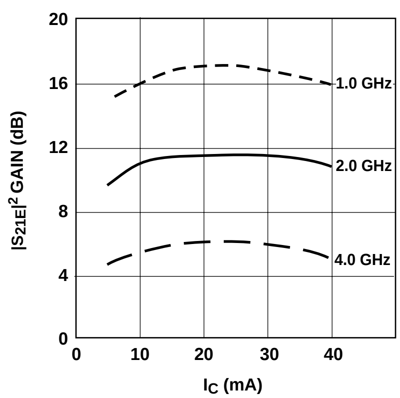


Figure 6. Insertion Power Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

AT-41435 Typical Scattering Parameters,

Common Emitter, $Z_O = 50\ \Omega$, $T_A = 25°C$, $V_{CE} = 8$ 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	.80	-32	28.0	24.99	157	-39.2	.011	82	.93	-12
0.5	.50	-110	21.8	12.30	108	-29.6	.033	52	.61	-28
1.0	.40	-152	16.6	6.73	85	-26.2	.049	56	.51	-30
1.5	.38	-176	13.3	4.63	71	-24.0	.063	59	.48	-32
2.0	.39	166	11.0	3.54	60	-21.9	.080	58	.46	-37
2.5	.41	156	9.3	2.91	53	-20.4	.095	61	.44	-40
3.0	.44	145	7.9	2.47	43	-18.8	.115	61	.43	-48
3.5	.46	137	6.7	2.15	33	-17.5	.133	58	.43	-58
4.0	.46	127	5.6	1.91	23	-16.0	.153	53	.45	-68
4.5	.47	116	4.7	1.72	13	-15.0	.178	50	.46	-75
5.0	.49	104	4.0	1.58	3	-13.9	.201	47	.48	-82
5.5	.52	91	3.3	1.45	-7	-13.0	.224	40	.47	-89
6.0	.59	81	2.5	1.34	-17	-12.1	.247	36	.43	-101

AT-41435 Typical Scattering Parameters,

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

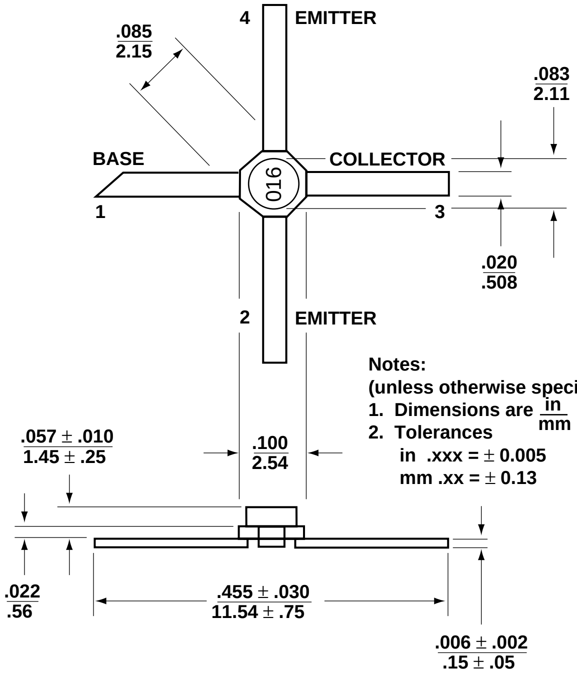
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.1	.63	-50	31.8	39.08	146	-40.0	.010	83	.84	-18
0.5	.39	-137	22.9	13.97	99	-31.4	.027	60	.50	-26
1.0	.36	-171	17.2	7.28	80	-27.1	.044	67	.45	-26
1.5	.36	171	13.9	4.94	68	-23.5	.067	66	.43	-30
2.0	.38	156	11.5	3.76	58	-21.6	.083	63	.41	-34
2.5	.40	149	9.8	3.08	52	-19.6	.105	63	.39	-38
3.0	.43	140	8.3	2.61	43	-18.3	.122	64	.38	-47
3.5	.45	132	7.2	2.28	33	-16.8	.144	59	.39	-57
4.0	.46	122	6.1	2.02	23	-15.6	.165	55	.40	-67
4.5	.46	112	5.2	1.82	14	-14.6	.185	50	.42	-75
5.0	.47	101	4.4	1.66	4	-13.7	.207	45	.43	-81
5.5	.51	89	3.7	1.54	-5	-12.6	.233	39	.42	-89
6.0	.58	79	3.0	1.41	-15	-11.8	.257	33	.37	-101

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

AT-41435 Noise Parameters: $V_{CE} = 8$ V, $I_C = 10$ mA

Freq. GHz	NF_O dB	Γ_{opt} Mag	Γ_{opt} Ang	$R_N/50$
0.1	1.2	.12	3	0.17
0.5	1.2	.10	14	0.17
1.0	1.3	.05	28	0.17
2.0	1.7	.30	-154	0.16
4.0	3.0	.54	-118	0.35

35 micro-X Package Dimensions



Notes:
(unless otherwise specified)
1. Dimensions are $\frac{\text{in}}{\text{mm}}$
2. Tolerances
   in .xxx = ± 0.005
   mm .xx = ± 0.13

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Data subject to change.

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