# AT-41435

Up to 6 GHz Low Noise Silicon Bipolar Transistor

# **Data Sheet**

## Description

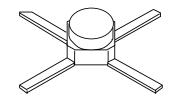
Avago's AT-41435 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-41435 is housed in a cost effective surface mount 100 mil micro-X package. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 14 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 $\Omega$  at 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-41435 bipolar transistor is fabricated using Avago's 10 GHz f<sub>T</sub> 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.

### 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 fT
- Cost Effective Ceramic Microstrip Package

### 35 micro-X Package





### AT-41435 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum <sup>[1]</sup>
V <sub>EBO</sub>	Emitter-Base Voltage	V	1.5
V <sub>CBO</sub>	Collector-Base Voltage	V	20
V <sub>CEO</sub>	Collector-Emitter Voltage	V	12
Ι <sub>C</sub>	Collector Current	mA	60
P <sub>T</sub>	Power Dissipation <sup>[2,3]</sup>	mW	500
Tj	Junction Temperature	°C	150
T <sub>STG</sub>	Storage Temperature <sup>[4]</sup>	°C	-65 to 150

# Notes:

1. Permanent damage may occur if any of these limits are exceeded.

- 2.  $T_{CASE} = 25^{\circ}C.$
- 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.
- 5. The small spot size of this technique results in a higher, though more accurate determination of  $\theta_{jc}$  than do alternate methods. See MEASUREMENTS section "Thermal Resistance" for more information.

# Electrical Specifications, $T_A = 25^{\circ}C$

Symbol	Parameters and Test Conditions		Units	Min.	Тур.	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 <sub>1 dB</sub>	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 <sub>1 dB</sub>	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 <sub>O</sub>	Optimum Noise Figure: V <sub>CE</sub> = 8 V, I <sub>C</sub> = 10 mA	f = 1.0  GHz f = 2.0  GHz f = 4.0  GHz	dB		1.3 1.7 3.0	2.0
G <sub>A</sub>	Gain @ NF <sub>O</sub> ; $V_{CE}$ = 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 <sub>T</sub>	Gain Bandwidth Product: $V_{CE} = 8 V$ , $I_C = 25 mA$		GHz		8.0	
h <sub>FE</sub>	Forward Current Transfer Ratio; $V_{CE} = 8 V$ , $I_C = 10 mA$		_	30	150	270
I <sub>CBO</sub>	Collector Cutoff Current; $V_{CB} = 8 V$		μΑ			0.2
I <sub>EBO</sub>	Emitter Cutoff Current; $V_{EB} = 1 V$		μΑ			1.0
C <sub>CB</sub>	Collector Base Capacitance <sup>[1]</sup> : $V_{CB} = 8 V$ , f = 1 MHz		pF		0.2	

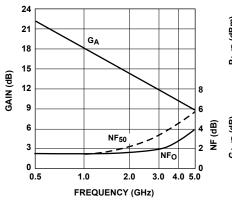
### Note:

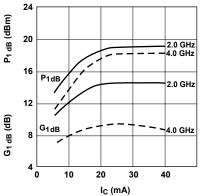
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1. For this test, the emitter is grounded.

Thermal Resistance<sup>[2,5]</sup>:  $\theta_{jc} = 200^{\circ}C/W$ 

# AT-41435 Typical Performance, $T_A = 25^{\circ}C$





 $\begin{array}{ll} \mbox{Figure 1. Noise Figure and Associated} \\ \mbox{Gain vs. Frequency.} \\ \mbox{V}_{CE} = 8 \mbox{ V, } I_C = 10 \mbox{ mA.} \end{array} \qquad \begin{array}{ll} \mbox{Figure 2. Output Power and 1 dB} \\ \mbox{Compressed Gain vs. Collector Current} \\ \mbox{and Frequency. } V_{CE} = 8 \mbox{ V.} \end{array}$ 

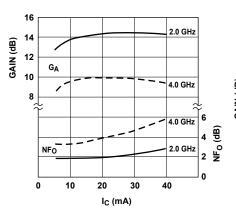


Figure 4. Optimum Noise Figure and Associated Gain vs. Collector Current and Frequency.  $V_{CE} = 8 V$ .

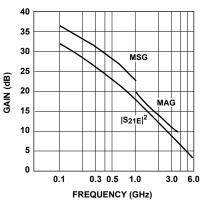


Figure 5. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency.  $V_{CE}$  = 8 V, I<sub>C</sub> = 25 mA.

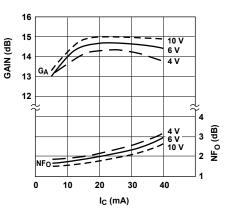


Figure 3. Optimum Noise Figure and Associated Gain vs. Collector Current and Collector Voltage. f = 2.0 GHz.

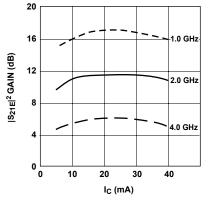


Figure 6. Insertion Power Gain vs. Collector Current and Frequency.  $V_{CE}$  = 8 V.

Freq.	Freq. S <sub>11</sub>		S <sub>11</sub> S <sub>21</sub>				S <sub>12</sub>			S <sub>22</sub>	
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	

AT-41435 Typical Scattering Parameters, Common Emitter,  $Z_O = 50 \ \Omega$ ,  $T_A = 25^{\circ}$ C,  $V_{CE} = 8 \ V$ ,  $I_C = 25 \ mA$ 

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

AT-41435 Typical Scattering Parameters, Common Emitter,  $Z_O = 50 \ \Omega$ ,  $T_A = 25^{\circ}$ C,  $V_{CE} = 8 \ V$ ,  $I_C = 10 \ mA$ 

Freq. S <sub>11</sub>			S <sub>21</sub>			S <sub>12</sub>			S <sub>22</sub>	
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 Noise Parameters:

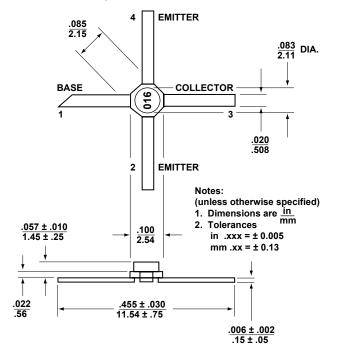
 $V_{CF} = 8 V_1 I_C = 10 mA$ 

$v_{CE} = 0 v, v_{C} = 10$	ША			
Freq.	NFo	$\Gamma_{\sf opt}$		D /50
GHz	dB	Mag	Ang	R <sub>N</sub> /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

## **Ordering Information**

Part Numbers	No. of Devices
AT-41435G	100

# 35 micro-X Package Dimensions



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

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