AVANTEK

AT-41435
Up to 6 GHz Low Noise Silicon Bipolar Transistor

T-31-21

Features

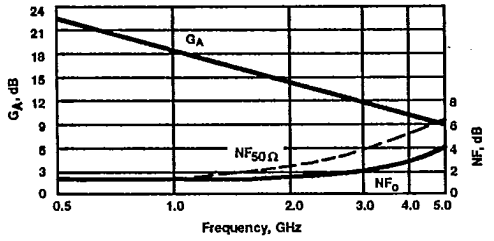
- **Low Noise Figure: 1.7 dB typical at 2.0 GHz 3.0 dB typical at 4.0 GHz**
- **High Associated Gain: 14.0 dB typical at 2.0 GHz 10.0 dB typical at 4.0 GHz**
- **High Gain-Bandwidth Product: 8.0 GHz typical f_T**
- **Cost Effective Ceramic Microstrip Package**

Description

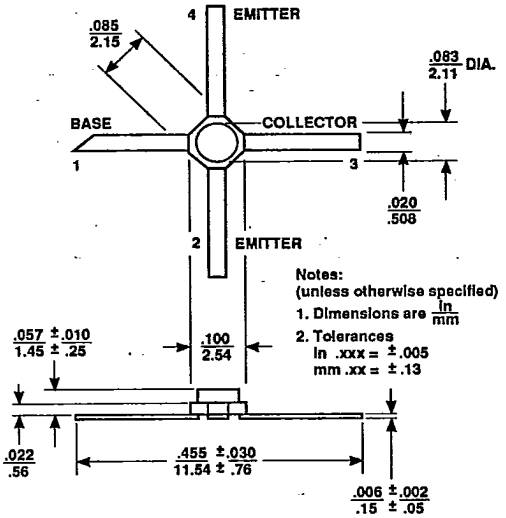
Avantek's AT-41435 is a high performance NPN silicon bipolar transistor housed in a cost effective, microstrip package. This device is designed for use in low noise, wide band amplifier and oscillator applications operating over VHF, UHF and microwave frequencies.

Excellent device uniformity, performance and reliability are produced by the use of ion-implantation, self-alignment techniques, and gold metallization in the fabrication of these devices.

NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY
V_{CE} = 8 V, I_C = 10 mA



Avantek 35 micro-X Package



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

Freq. GHz	NF_O dB	Gamma Opt Mag	Gamma 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

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
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	
$\|S_{21E}\|^2$	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	
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	300
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.

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Low Noise Silicon Bipolar Transistor

Absolute Maximum Ratings

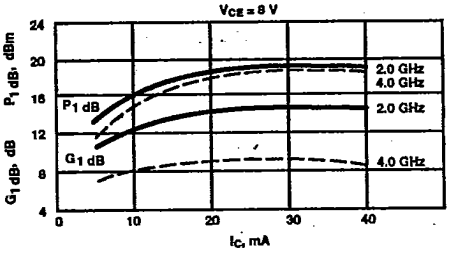
Parameter	Symbol	Absolute Maximum[1]
Emitter-Base Voltage	V_{EBO}	1.5 V
Collector-Base Voltage	V_{CBO}	20 V
Collector-Emitter Voltage	V_{CEO}	12 V
Collector Current	I_C	60 mA
Power Dissipation[2,3]	P_T	500 mW
Junction Temperature	T_j	200°C
Storage Temperature[4]	T_{STG}	–65°C to 200°C

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

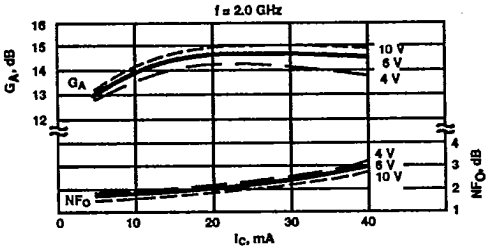
Notes:
1. Operation of this device above any one of these parameters may cause permanent damage.
2. T_{CASE} = 25°C.
3. Derate at 5 mW/°C for T_C > 100°C.
4. Storage above +150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into 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.

Typical Performance, T_A = 25°C
(unless otherwise noted)

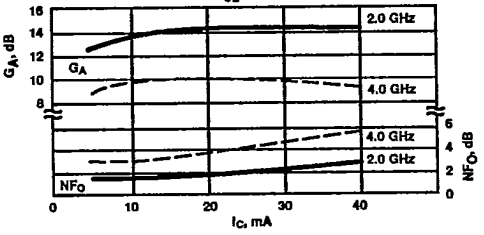
OUTPUT POWER AND 1 dB COMPRESSED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8 V



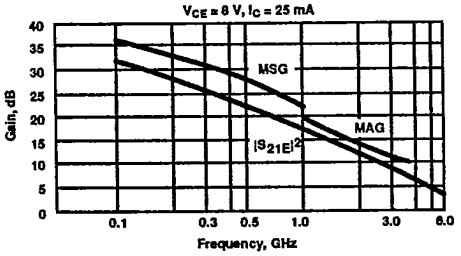
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT AND COLLECTOR VOLTAGE
f = 2.0 GHz



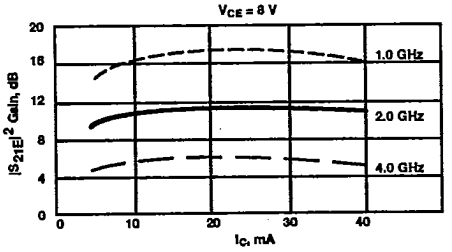
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8 V



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8 V, I_C = 25 mA



INSERTION POWER GAIN vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8 V



Typical Scattering Parameters: Common Emitter, $Z_O = 50\ \Omega$ $T_A = 25°C$, $V_{CE} = 8$ V, $I_C = 10$ mA

Freq. GHz	S_{11}		S_{21}			S_{12}			S_{22}	
	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

$T_A = 25°C$, $V_{CE} = 8$ V, $I_C = 25$ mA

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.