AT-60510
Up to 6 GHz Low Noise Silicon Bipolar Transistor

Features

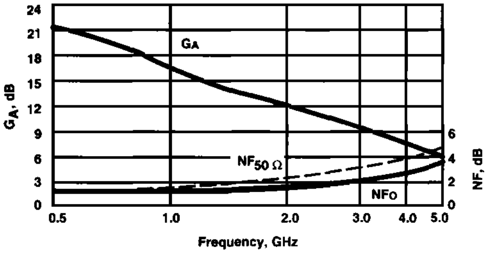
- **Low Bias Current Operation:**
- **Low Noise Figure: 1.8 dB typical at 2.0 GHz**
  2.8 dB typical at 4.0 GHz
- **High Associated Gain: 12.0 dB typical at 2.0 GHz**
  7.5 dB typical at 4.0 GHz
- **High Gain-Bandwidth Product: 8.0 GHz typical f_T**
- **Hermetic Gold-ceramic Microstrip Package**

Description

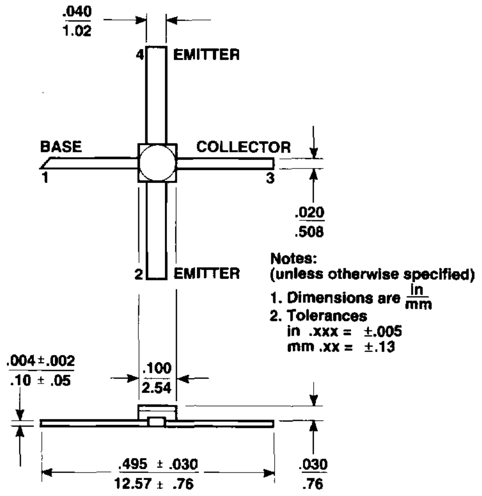
The AT-60510 is a high performance NPN silicon bipolar transistor housed in a hermetic, high reliability package. This device is designed for use in low noise, wide band amplifier and oscillator applications operating over VHF, UHF and microwave frequencies.

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 = 2 mA



100 mil Package



Notes:
(unless otherwise specified)
1. Dimensions are $\frac{\text{in}}{\text{mm}}$
2. Tolerances
in .xxx = ±.005
mm .xx = ±.13

Outline 10A

Noise Parameters: V_{CE} = 8 V, I_C = 2 mA

Freq. GHz	NFo dB	Gamma Opt Mag	Gamma Opt Ang	$R_N/50$
1.0	1.4	.50	50	0.32
2.0	1.8	.44	97	0.42
4.0	2.8	.38	−163	0.42

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 = 2 mA	f = 1.0 GHz	dB		1.4	
		f = 2.0 GHz			1.8	2.1
		f = 4.0 GHz			2.8	
G_A	Gain @ NF_O: V_{CE} = 8 V, I_C = 2 mA	f = 1.0 GHz	dB		16.5	
		f = 2.0 GHz		11.0	12.0	
		f = 4.0 GHz			7.5	
$\|S_{21E}\|^2$	Insertion Power Gain: V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz	dB		12.0	
		f = 4.0 GHz			6.5	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression: V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz	dBm		16.0	
$G_{1\,dB}$	1 dB Compressed Gain: V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz	dB		11.5	
f_T	Gain Bandwidth Product: V_{CE} = 8 V, I_C = 10 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		0.15	

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

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	40 mA
Power Dissipation[2,3]	P_T	400 mW
Junction Temperature	T_j	200°C
Storage Temperature	T_{STG}	−65°C to 200°C

Thermal Resistance[2,4]: $\theta_{jc} = 200°C/W$

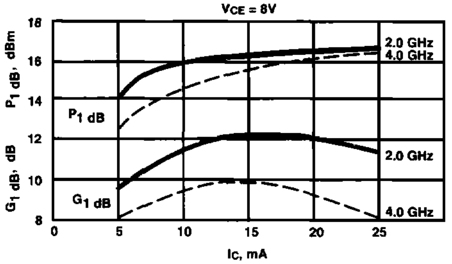
Notes:

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 $T_C > 120°C$.
4. 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.

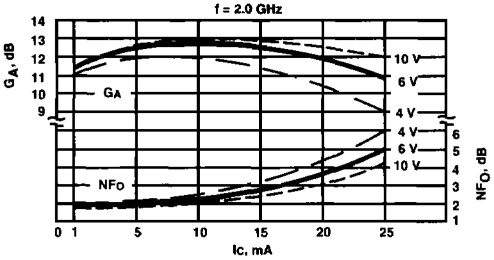
Typical Performance, $T_A = 25°C$

(unless otherwise noted)

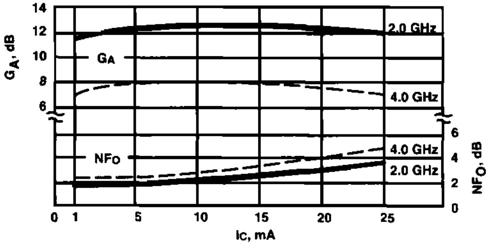
OUTPUT POWER AND 1 dB COMPRESSED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
$V_{CE} = 8V$



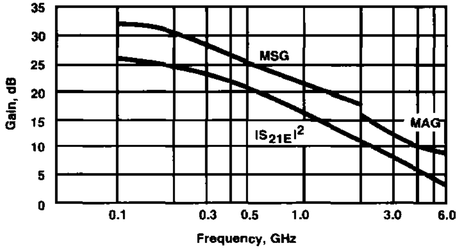
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT AND COLLECTOR VOLTAGE
f = 2.0 GHz



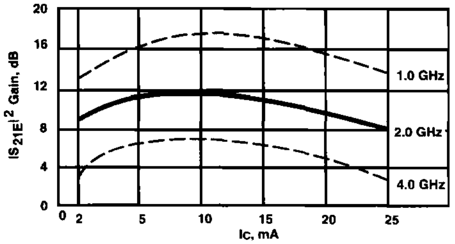
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
$V_{CE} = 8 V$



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN AND MAXIMUM STABLE GAIN vs. FREQUENCY
$V_{CE} = 8 V, I_C = 10 mA$



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, $I_C = 2$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.95	−10	15.9	6.25	171	−39.2	.011	91	.99	−4
0.5	.86	−47	14.8	5.46	141	−26.8	.046	61	.92	−19
1.0	.71	−82	12.4	4.16	112	−23.0	.071	43	.83	−31
1.5	.59	−108	10.3	3.26	92	−21.8	.082	33	.76	−38
2.0	.52	−131	8.4	2.63	76	−21.2	.088	26	.72	−44
2.5	.48	−146	7.0	2.25	66	−20.4	.095	27	.70	−45
3.0	.45	−162	5.8	1.94	54	−21.0	.089	24	.68	−50
3.5	.45	−178	4.6	1.71	42	−20.4	.096	21	.69	−56
4.0	.43	167	3.6	1.52	31	−20.0	.100	22	.70	−63
4.5	.42	152	2.8	1.38	20	−19.6	.105	20	.70	−68
5.0	.41	134	2.0	1.26	9	−19.1	.111	18	.70	−73
5.5	.43	116	1.4	1.17	0	−18.5	.119	16	.70	−77
6.0	.48	101	0.7	1.09	−10	−18.2	.123	16	.67	−83

$T_A = 25°C$, $V_{CE} = 8$ 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	.71	−26	26.6	21.30	162	−39.2	.011	75	.96	−9
0.5	.55	−100	22.1	12.77	116	−30.8	.029	50	.71	−27
1.0	.46	−141	17.3	7.36	90	−27.6	.042	43	.59	−31
1.5	.43	−165	14.1	5.11	76	−25.6	.052	48	.57	−35
2.0	.42	178	11.8	3.91	64	−24.2	.061	45	.55	−40
2.5	.43	168	10.1	3.21	57	−23.4	.068	54	.54	−41
3.0	.43	157	8.7	2.72	48	−21.8	.081	53	.54	−47
3.5	.44	145	7.5	2.37	37	−20.8	.092	50	.55	−55
4.0	.44	134	6.4	2.10	27	−19.8	.102	45	.56	−62
4.5	.43	121	5.5	1.88	17	−18.9	.114	42	.58	−69
5.0	.44	106	4.6	1.71	7	−18.2	.123	38	.59	−76
5.5	.47	92	3.8	1.56	−1	−17.5	.134	33	.59	−81
6.0	.52	81	3.1	1.42	−11	−16.8	.145	29	.57	−88

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