HEWLETT PACKARD

AT-60570
Up to 6 GHz Low Noise Silicon Bipolar Transistor

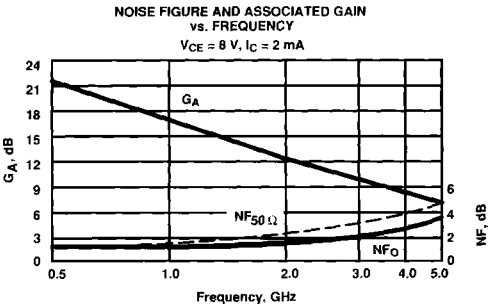
Features

- **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: 12.5 dB typical at 2.0 GHz**
  8.0 dB typical at 4.0 GHz
- **High Gain-Bandwidth Product: 8.0 GHz typical f_T**
- **Hermetic Gold-ceramic Microstrip Package**

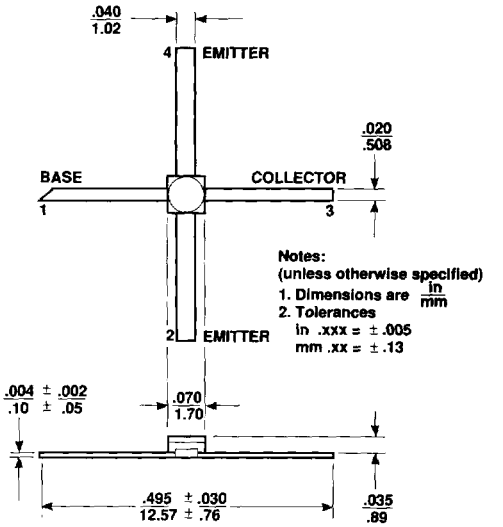
Description

The AT-60570 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.



70 mil Package



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

Freq. GHz	NF_O dB	Gamma Opt Mag	Gamma Opt Ang	$R_N/50$
1.0	1.4	.54	48	0.20
2.0	1.8	.44	98	0.28
4.0	2.8	.40	180	0.28

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	12.5	
		f = 4.0 GHz			8.0	
$\|S_{21E}\|^2$	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		12.5	
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]: θ_{jc} = 200°C/W

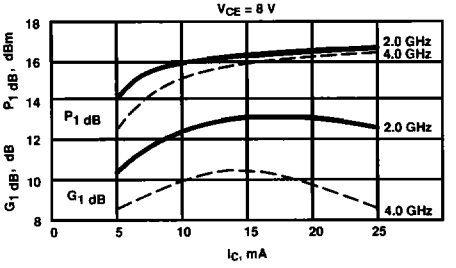
Notes:

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.

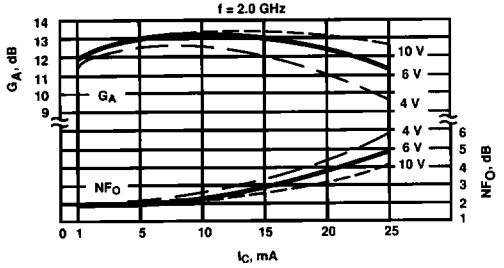
Typical Performance, T_A = 25°C

(unless otherwise noted)

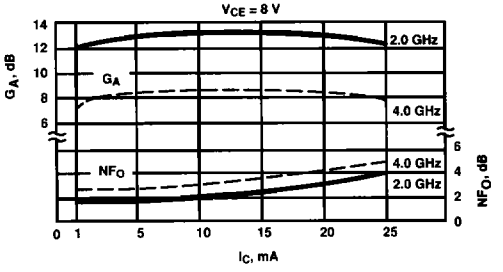
OUTPUT POWER AND 1 dB COMPRESSED GAIN
vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8 V



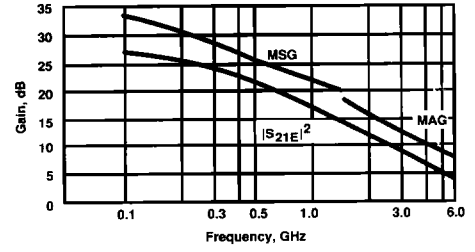
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN
vs. COLLECTOR CURRENT AND COLLECTOR VOLTAGE
f = 2.0 GHz



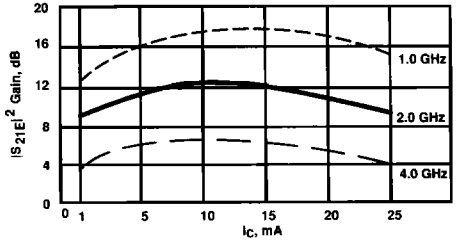
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN
vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8 V



INSERTION POWER GAIN, MAXIMUM AVAILABLE
GAIN AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8 V, I_C = 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. GHz	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.95	–10	16.6	6.74	171	–38.4	.012	86	.99	–4
0.5	.86	–48	15.3	5.81	141	–27.2	.044	63	.92	–19
1.0	.72	–83	12.8	4.38	113	–23.0	.070	43	.81	–30
1.5	.62	–108	10.7	3.42	95	–22.0	.080	35	.74	–37
2.0	.56	–128	8.8	2.75	80	–21.2	.088	28	.70	–43
2.5	.52	–141	7.4	2.34	72	–20.6	.094	28	.67	–44
3.0	.51	–153	6.1	2.02	61	–20.8	.092	27	.66	–51
3.5	.51	–164	4.9	1.75	50	–20.4	.095	24	.67	–58
4.0	.49	–172	3.8	1.55	40	–20.0	.099	25	.67	–65
4.5	.48	179	2.8	1.38	31	–19.8	.102	22	.69	–71
5.0	.46	169	2.1	1.27	22	–19.5	.106	21	.69	–76
5.5	.44	158	1.5	1.19	14	–19.2	.110	22	.70	–80
6.0	.44	145	0.9	1.11	4	–18.4	.120	20	.69	–86

$T_A = 25°C$, $V_{CE} = 8$ V, $I_C = 10$ mA

0.1	.77	–26	27.3	23.25	161	–39.2	.011	79	.96	–9
0.5	.57	–98	22.6	13.51	116	–31.0	.028	49	.69	–27
1.0	.49	–136	17.8	7.72	92	–27.8	.041	45	.58	–31
1.5	.45	–156	14.6	5.36	79	–26.2	.049	45	.54	–34
2.0	.44	–171	12.3	4.10	69	–24.6	.059	48	.53	–39
2.5	.44	–177	10.5	3.35	63	–23.0	.070	51	.52	–39
3.0	.45	174	9.1	2.84	55	–23.0	.071	52	.52	–47
3.5	.45	167	7.8	2.46	46	–21.4	.086	52	.53	–56
4.0	.44	160	6.7	2.16	37	–20.2	.097	50	.55	–63
4.5	.42	153	5.7	1.92	29	–19.3	.108	47	.57	–70
5.0	.40	144	4.9	1.75	21	–18.7	.116	44	.59	–75
5.5	.40	132	4.2	1.62	13	–18.1	.124	41	.60	–79
6.0	.41	121	3.5	1.49	4	–17.3	.137	38	.60	–86

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