Up to 6 GHz Medium Power Silicon Bipolar Transistor

Technical Data

AT-42070

Features

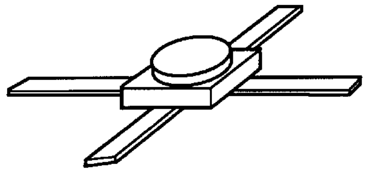
- **High Output Power:**
  21.0 dBm Typical $P_{1\ dB}$ at 2.0 GHz
  20.5 dBm Typical $P_{1\ dB}$ at 4.0 GHz
- **High Gain at 1 dB Compression:**
  15.0 dB Typical $G_{1\ dB}$ at 2.0 GHz
  10.0 dB Typical $G_{1\ dB}$ at 4.0 GHz
- **Low Noise Figure:**
  1.9 dB Typical NF_O at 2.0 GHz
- **High Gain-Bandwidth Product:** 8.0 GHz Typical f_T
- **Hermetic Gold-ceramic Microstrip Package**

Description

Hewlett-Packard's AT-42070 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-42070 is housed in a hermetic, high reliability gold-ceramic 70 mil microstrip package. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 20 emitter finger interdigitated geometry yields a medium sized transistor with impedances that are easy to match for low noise and medium 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 up to 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-42070 bipolar transistor is fabricated using Hewlett-Packard'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.

70 mil Package



AT-42070 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	80
P_T	Power Dissipation [2,3]	mW	600
T_j	Junction Temperature	°C	200
T_{STG}	Storage Temperature	°C	-65 to 200

Thermal Resistance [2,4]:
θ_{jc} = 150°C/W

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 6.7 mW/°C for T_C > 110°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.

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions[1]		Units	Min.	Typ.	Max.
$\|S_{21E}\|^2$	Insertion Power Gain; V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz f = 4.0 GHz	dB	10.5	11.5 5.5	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz f= 4.0 GHz	dBm		21.0 20.5	
$G_{1\,dB}$	1 dB Compressed Gain; V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz f = 4.0 GHz	dB		15.0 10.0	
NF_O	Optimum Noise Figure: V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz f = 4.0 GHz	dB		1.9 3.0	
G_A	Gain @ NF_O; V_{CE} = 8 V, I_C = 10 mA	f = 2.0 GHz f = 4.0 GHz	dB		14.0 10.5	
f_T	Gain Bandwidth Product: V_{CE} = 8 V, I_C = 35 mA		GHz		8.0	
h_{FE}	Forward Current Transfer Ratio; V_{CE} = 8 V, I_C = 35 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			2.0
C_{CB}	Collector Base Capacitance[1]: V_{CB} = 8 V, f = 1 MHz		pF		0.28	

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

AT-42070 Typical Performance, $T_A = 25°C$

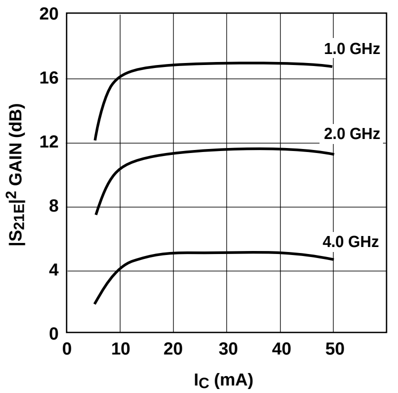


Figure 1. Insertion Power Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

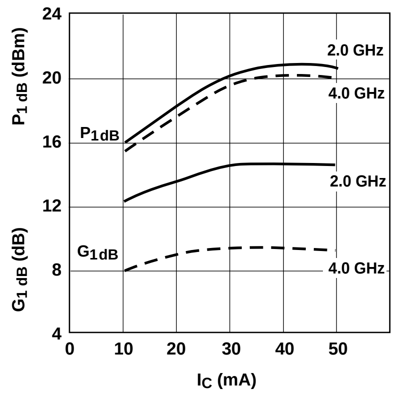


Figure 2. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

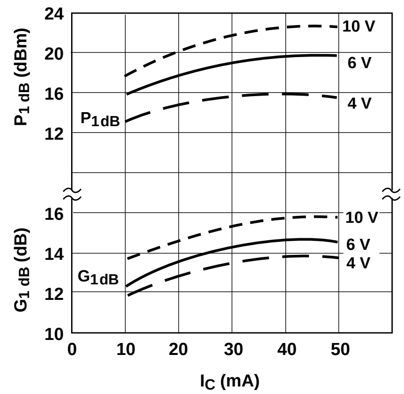


Figure 3. Output Power and 1 dB Compressed Gain vs. Collector Current and Voltage. f = 2.0 GHz.

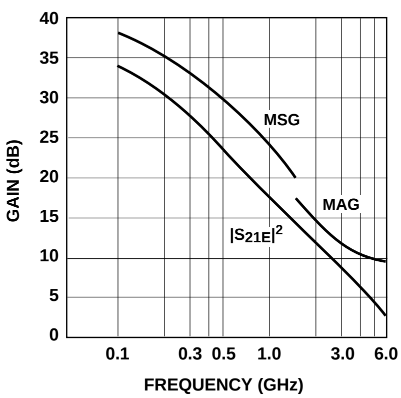


Figure 4. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{CE} = 8 V, I_C = 35 mA.

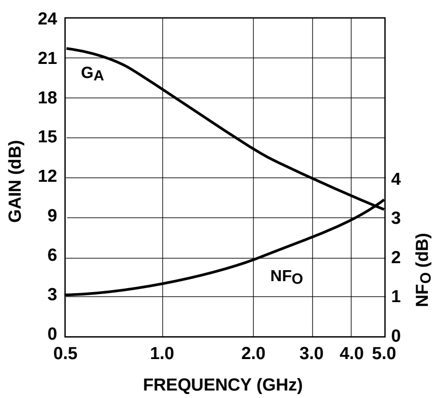


Figure 5. Noise Figure and Associated Gain vs. Frequency. V_{CE} = 8 V, I_C = 10 mA.

AT-42070 Typical Scattering Parameters,

Common Emitter, Z_O = 50 Ω, 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	.70	-49	28.5	26.56	154	-36.0	.016	77	.91	-18
0.5	.69	-137	21.5	11.85	105	-29.6	.033	34	.50	-41
1.0	.69	-165	16.0	6.34	85	-27.2	.044	29	.40	-44
1.5	.68	-179	12.7	4.33	72	-27.4	.043	37	.38	-48
2.0	.69	169	10.3	3.26	62	-25.6	.052	42	.37	-54
2.5	.69	164	8.5	2.64	56	-25.4	.054	46	.37	-55
3.0	.70	157	6.9	2.22	48	-23.8	.065	52	.39	-63
3.5	.70	151	5.6	1.91	39	-22.4	.076	51	.41	-71
4.0	.69	144	4.5	1.68	30	-21.4	.085	55	.43	-77
4.5	.68	137	3.5	1.50	22	-20.4	.096	49	.46	-83
5.0	.68	128	2.7	1.37	14	-19.4	.107	50	.48	-87
5.5	.68	117	2.0	1.26	5	-18.3	.121	45	.48	-91
6.0	.70	107	1.2	1.15	-3	-17.6	.132	44	.48	-98

AT-42070 Typical Scattering Parameters,

Common Emitter, Z_O = 50 Ω, T_A = 25°C, V_{CE} = 8 V, I_C = 35 mA

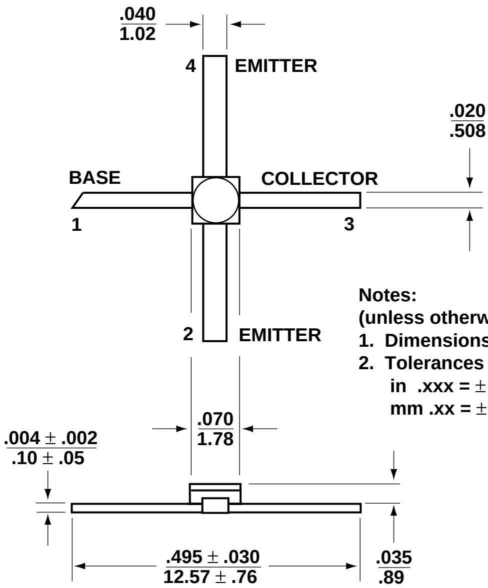
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.1	.52	-95	33.4	46.52	139	-40.0	.010	50	.77	-29
0.5	.66	-163	23.1	14.33	95	-34.4	.019	46	.34	-42
1.0	.67	179	17.3	7.36	80	-29.6	.033	51	.28	-41
1.5	.67	169	13.9	4.97	69	-28.0	.040	59	.27	-44
2.0	.68	160	11.4	3.74	60	-27.3	.053	59	.27	-51
2.5	.69	157	9.6	3.04	55	-23.8	.065	65	.28	-53
3.0	.69	151	8.1	2.55	47	-22.8	.072	65	.28	-62
3.5	.69	145	6.8	2.20	39	-21.4	.086	59	.30	-72
4.0	.68	139	5.7	1.93	20	-20.2	.097	60	.33	-80
4.5	.67	132	4.7	1.74	22	-19.3	.109	54	.36	-85
5.0	.67	123	4.0	1.59	13	-18.0	.126	50	.38	-90
5.5	.67	113	3.2	1.46	5	-17.2	.138	46	.39	-94
6.0	.69	103	2.5	1.34	-4	-16.4	.152	40	.38	-102

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

AT-42070 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	1.0	.05	15	0.13
0.5	1.1	.06	75	0.13
1.0	1.5	.10	126	0.12
2.0	1.9	.23	172	0.11
4.0	3.0	.45	-145	0.17

70 mil 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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