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# Up to 6 GHz Medium Power Silicon Bipolar Transistor

## Technical Data

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### AT-42085

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#### Features

- **High Output Power:**  
20.5 dBm Typical  $P_{1\text{dB}}$  at 2.0 GHz
- **High Gain at 1 dB  
Compression:**  
14.0 dB Typical  $G_{1\text{dB}}$  at 2.0 GHz
- **Low Noise Figure:**  
2.0 dB Typical  $NF_0$  at 2.0 GHz
- **High Gain-Bandwidth  
Product:** 8.0 GHz Typical  $f_T$
- **Low Cost Plastic Package**

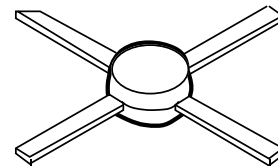
#### Description

Hewlett-Packard's AT-42085 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-42085 is housed in a low cost .085" diameter plastic 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. Applications include use in wireless systems as an LNA, gain stage, buffer, oscillator, and mixer. An optimum noise match near  $50\ \Omega$  up to 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-42085 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.

#### 85 Plastic Package



## AT-42085 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
I <sub>C</sub>	Collector Current	mA	80
P <sub>T</sub>	Power Dissipation <sup>[2,3]</sup>	mW	500
T <sub>j</sub>	Junction Temperature	°C	150
T <sub>STG</sub>	Storage Temperature	°C	-65 to 150

### Thermal Resistance<sup>[2,4]</sup>:

$$\theta_{jc} = 130^{\circ}\text{C}/\text{W}$$

#### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. T<sub>CASE</sub> = 25°C.
3. Derate at 7.7 mW/°C for T<sub>C</sub> > 85°C.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

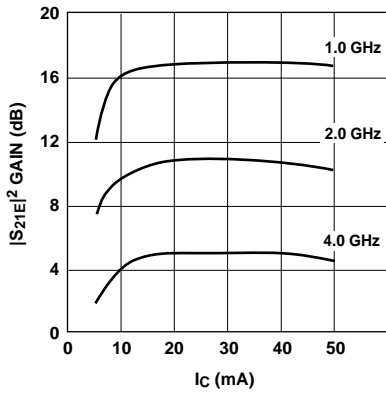
## Electrical Specifications, T<sub>A</sub> = 25°C

Symbol	Parameters and Test Conditions	Units	Min.	Typ.	Max.
S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain; V <sub>CE</sub> = 8 V, I <sub>C</sub> = 35 mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB	15.5	17.0 11.0 5.0
P <sub>1dB</sub>	Power Output @ 1 dB Gain Compression V <sub>CE</sub> = 8 V, I <sub>C</sub> = 35 mA	f = 2.0 GHz f = 4.0 GHz	dBm		20.5 20.0
G <sub>1dB</sub>	1 dB Compressed Gain; V <sub>CE</sub> = 8 V, I <sub>C</sub> = 35 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 = 2.0 GHz f = 4.0 GHz	dB		2.0 3.5
G <sub>A</sub>	Gain @ NF <sub>O</sub> ; V <sub>CE</sub> = 8 V, I <sub>C</sub> = 10 mA	f = 2.0 GHz f = 4.0 GHz	dB		13.5 9.5
f <sub>T</sub>	Gain Bandwidth Product; V <sub>CE</sub> = 8 V, I <sub>C</sub> = 35 mA		GHz		8.0
h <sub>FE</sub>	Forward Current Transfer Ratio; V <sub>CE</sub> = 8 V, I <sub>C</sub> = 35 mA		—	30	150 270
I <sub>CBO</sub>	Collector Cutoff Current; V <sub>CB</sub> = 8 V		μA		0.2
I <sub>EBO</sub>	Emitter Cutoff Current; V <sub>EB</sub> = 1 V		μA		2.0
C <sub>CB</sub>	Collector Base Capacitance <sup>[1]</sup> ; V <sub>CB</sub> = 8 V, f = 1 MHz		pF		0.32

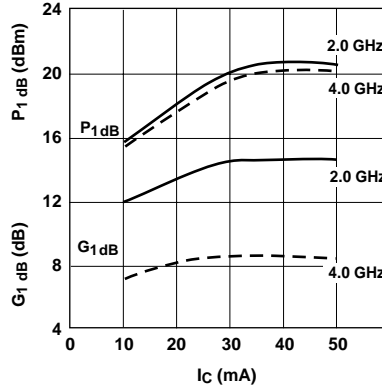
#### Note:

1. For this test, the emitter is grounded.

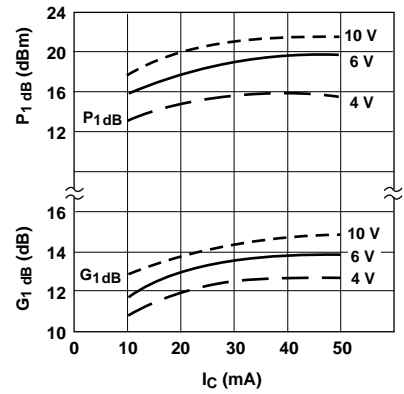
**AT-42085 Typical Performance,  $T_A = 25^\circ\text{C}$**



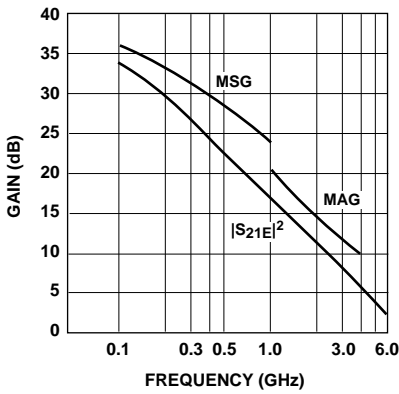
**Figure 1. Insertion Power Gain vs. Collector Current and Frequency.  $V_{CE} = 8\text{ V}$ .**



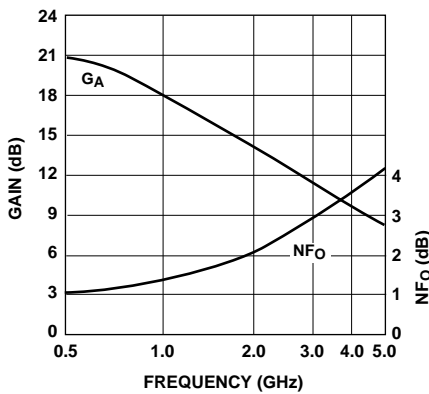
**Figure 2. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency.  $V_{CE} = 8\text{ V}$ .**



**Figure 3. Output Power and 1 dB Compressed Gain vs. Collector Current and Voltage.  $f = 2.0\text{ GHz}$ .**



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



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

### AT-42085 Typical Scattering Parameters,

Common Emitter,  $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_{CE} = 8\text{V}$ ,  $I_C = 10\text{mA}$

Freq. GHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
0.1	.72	-50	28.5	26.52	152	-37.0	.014	73	.90	-16
0.5	.66	-139	21.0	11.23	103	-29.2	.035	36	.53	-32
1.0	.65	-168	15.5	5.96	84	-28.6	.037	39	.45	-33
1.5	.65	175	12.2	4.06	71	-27.0	.045	46	.43	-36
2.0	.65	163	9.7	3.06	60	-25.3	.054	51	.42	-41
2.5	.66	157	8.0	2.51	55	-24.0	.063	60	.42	-42
3.0	.68	149	6.3	2.07	46	-22.8	.072	65	.41	-48
3.5	.68	141	5.1	1.79	38	-21.4	.085	64	.43	-55
4.0	.69	133	3.9	1.57	29	-19.7	.104	64	.45	-61
4.5	.69	125	3.0	1.41	21	-18.5	.119	63	.46	-66
5.0	.69	114	2.2	1.28	12	-17.1	.139	58	.47	-71
5.5	.71	103	1.4	1.17	3	-15.9	.161	55	.44	-76
6.0	.75	91	0.6	1.07	-6	-15.1	.177	49	.40	-85

### AT-42085 Typical Scattering Parameters,

Common Emitter,  $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_{CE} = 8\text{V}$ ,  $I_C = 35\text{mA}$

Freq. GHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
0.1	.54	-90	33.1	45.38	137	-40.1	.010	66	.76	-26
0.5	.61	-163	22.6	13.45	95	-32.8	.023	52	.38	-30
1.0	.61	178	16.8	6.90	79	-29.5	.034	61	.34	-28
1.5	.62	167	13.4	4.67	68	-26.4	.048	68	.32	-31
2.0	.63	156	10.9	3.52	59	-23.9	.064	66	.31	-36
2.5	.64	152	9.2	2.89	54	-22.5	.075	68	.31	-40
3.0	.66	146	7.6	2.39	45	-21.2	.088	69	.30	-48
3.5	.67	139	6.3	2.07	37	-19.8	.102	67	.31	-58
4.0	.68	131	5.2	1.81	28	-18.6	.117	65	.33	-67
4.5	.68	123	4.2	1.62	19	-17.2	.138	60	.35	-73
5.0	.68	114	3.4	1.48	10	-16.4	.152	56	.35	-79
5.5	.71	103	2.5	1.34	1	-15.3	.171	50	.34	-85
6.0	.74	93	1.7	1.21	-8	-14.5	.188	46	.31	-96

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

### AT-42085 Noise Parameters: $V_{CE} = 8\text{V}$ , $I_C = 10\text{mA}$

Freq. GHz	$NF_0$ dB	$\Gamma_{opt}$		$R_N/50$
		Mag	Ang	
0.1	1.1	.05	16	0.13
0.5	1.2	.06	77	0.13
1.0	1.3	.10	131	0.12
2.0	2.0	.24	-179	0.11
4.0	3.5	.46	-128	0.25

# 85 Plastic Package Dimensions

