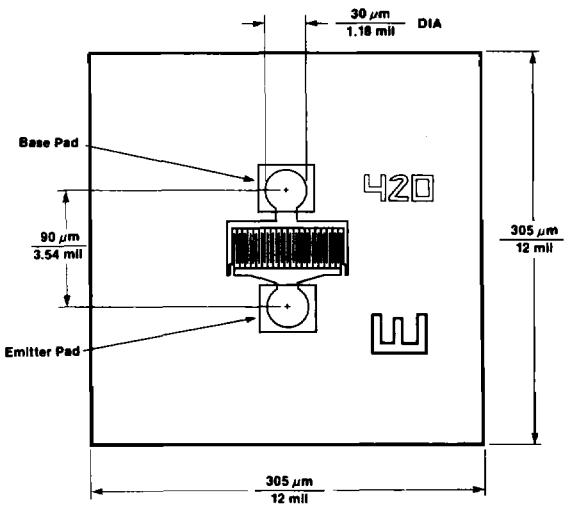
HEWLETT PACKARD

AT-42000
Up to 6 GHz Medium Power Silicon Bipolar Transistor Chip

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:**
  9.0 GHz typical f_T

Chip Outline



Description

The AT-42000 is a high performance NPN silicon bipolar transistor chip designed for use in medium power, wide band amplifier and oscillator applications operating over VHF, UHF and microwave frequencies.

The die are nitride-passivated for surface protection. 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.

The recommended assembly procedure is gold-eutectic die attach at 400°C and either wedge or ball bonding using 0.7 mil gold wire. See also "Chip Use" in the APPLICATIONS section.

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	1.0	.04	13	0.13
0.5	1.1	.05	69	0.13
1.0	1.5	.09	127	0.12
2.0	1.9	.23	171	0.11
4.0	3.0	.47	–154	0.14

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		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		9.0	
h_{FE}	Forward Current Transfer Ratio: V_{CE} = 8 V, I_C = 35 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			2.0
C_{CB}	Collector Base Capacitance[2]: V_{CB} = 8 V, f = 1 MHz		pF		0.23	

Notes: 1. RF performance is determined by packaging and testing 10 devices per wafer.
2. 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	80 mA
Power Dissipation[2,3]	P_T	600 mW
Junction Temperature	T_j	200°C
Storage Temperature	T_{STG}	−65°C to 200°C

Thermal Resistance[2,4]: θ_{jc} = 70°C/W

Notes:

1. Operation of this device above any one of these parameters may cause permanent damage.
2. $T_{MOUNTING\ SURFACE}$ = 25°C.
3. Derate at 14.3 mW/°C for $T_{MOUNTING\ SURFACE}$ > 158°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.

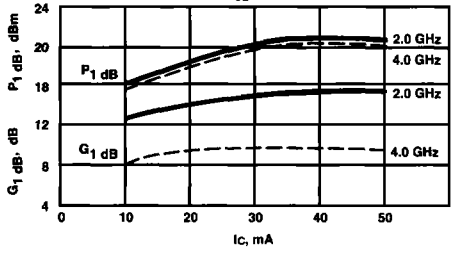
Part Number Ordering Information

Part Number	Devices Per Tray
AT-42000-GP2	10
AT-42000-GP4	100
AT-42000-GP6	up to 300

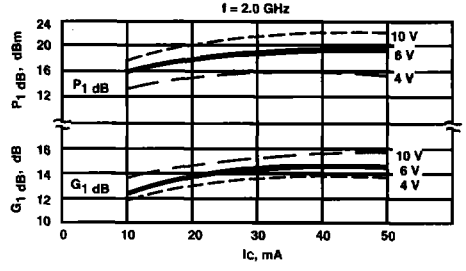
Typical Performance, T_A = 25°C

(unless otherwise noted)

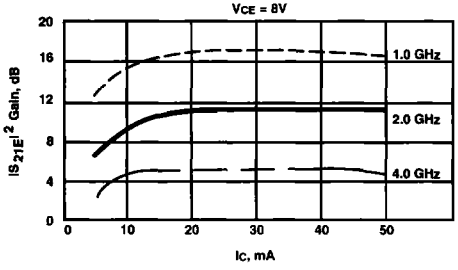
OUTPUT POWER AND 1 dB COMPRESSED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8 V



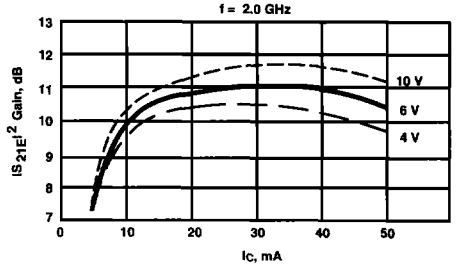
OUTPUT POWER AND 1 dB COMPRESSED GAIN vs. COLLECTOR CURRENT AND VOLTAGE
f = 2.0 GHz



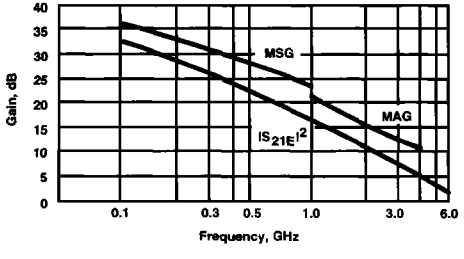
INSERTION POWER GAIN vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8V



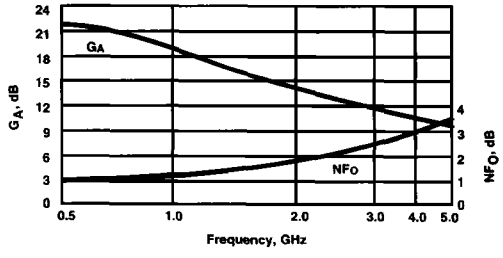
INSERTION POWER GAIN vs. COLLECTOR CURRENT AND VOLTAGE
f = 2.0 GHz



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8 V, I_C = 35 mA



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



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	.70	–50	28.0	25.19	155	–37.7	.013	71	.92	–14
0.5	.67	–136	20.9	11.04	108	–30.5	.030	43	.57	–27
1.0	.66	–166	15.7	6.08	90	–28.9	.036	47	.50	–24
1.5	.66	–173	12.1	4.02	86	–28.2	.039	52	.48	–23
2.0	.66	179	9.8	3.09	82	–27.5	.042	57	.47	–23
2.5	.67	170	7.8	2.46	74	–26.0	.050	66	.47	–23
3.0	.67	165	6.3	2.08	68	–24.7	.058	72	.47	–26
3.5	.70	157	5.1	1.80	61	–23.4	.068	77	.47	–28
4.0	.70	151	3.9	1.56	57	–21.8	.081	82	.48	–30
4.5	.71	145	2.9	1.40	51	–20.7	.092	86	.50	–34
5.0	.73	138	1.9	1.24	41	–19.3	.109	87	.51	–38
5.5	.74	132	1.2	1.15	36	–17.2	.138	88	.51	–50
6.0	.76	129	0.2	1.02	32	–16.3	.154	87	.53	–56

$T_A = 25°C$, $V_{CE} = 8$ V, $I_C = 35$ mA

0.1	.49	–96	33.0	44.61	143	–40.9	.009	65	.79	–24
0.5	.62	–163	22.8	13.87	98	–34.4	.019	58	.42	–26
1.0	.63	179	17.2	7.25	86	–30.5	.030	70	.38	–22
1.5	.63	171	13.5	4.74	78	–27.7	.041	76	.38	–23
2.0	.65	163	11.2	3.62	72	–25.4	.054	79	.38	–25
2.5	.65	159	9.3	2.90	67	–23.6	.066	82	.38	–27
3.0	.68	154	7.8	2.44	60	–22.1	.079	82	.38	–29
3.5	.67	148	6.5	2.12	57	–20.6	.093	84	.39	–32
4.0	.69	144	5.3	1.83	51	–19.7	.104	86	.40	–34
4.5	.70	139	4.4	1.65	47	–18.3	.121	86	.41	–40
5.0	.70	137	3.3	1.46	43	–17.5	.133	85	.42	–44
5.5	.72	131	2.7	1.36	38	–16.5	.149	86	.41	–48
6.0	.74	128	1.7	1.22	34	–15.7	.164	85	.44	–55

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