HEWLETT PACKARD

AT-41400
Up to 6 GHz Low Noise Silicon Bipolar Transistor Chip

Features

- **Low Noise Figure: 1.6 dB typical at 2.0 GHz**
  3.0 dB typical at 4.0 GHz
- **High Associated Gain: 14.5 dB typical at 2.0 GHz**
  10.5 dB typical at 4.0 GHz
- **High Gain-Bandwidth Product: 9.0 GHz typical f_T**

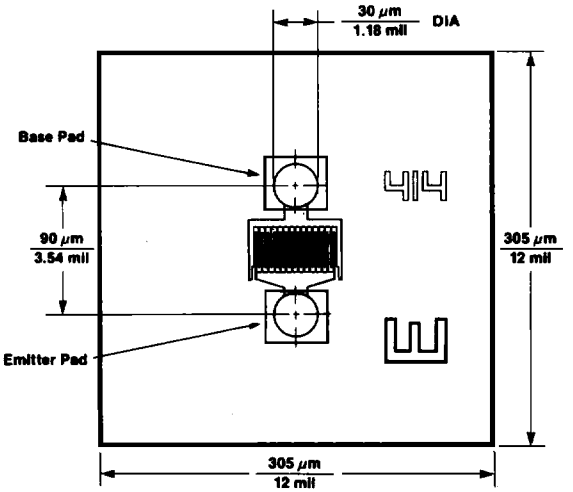
Description

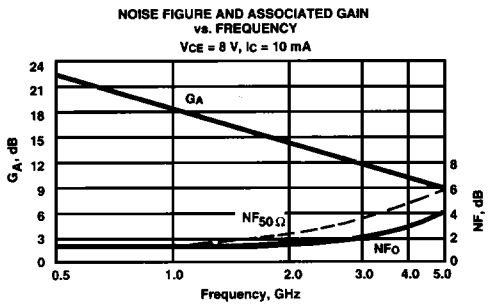
The AT-41400 is a high performance NPN silicon bipolar transistor chip designed for use low noise, wide band amplifier and oscillator applications operating over VHF, UHF and microwave frequencies.

The die are nitride-passivated for surface protection. Excellent device uniformity, performance and reliability are produced by the use of ion-implanation, 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.

Chip Outline





Noise Parameters: V_{CE} = 8 V, I_C = 10 mA

Freq. GHz	NFO dB	Gamma Opt Mag	Gamma Opt Ang	RN/50
0.1	1.2	.12	3	0.17
0.5	1.2	.10	15	0.17
1.0	1.3	.06	27	0.16
2.0	1.6	.24	163	0.16
4.0	3.0	.52	–153	0.18

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions[1]		Units	Min.	Typ.	Max.
NFO	Optimum Noise Figure: VCE = 8 V, IC = 10 mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB		1.3 1.6 3.0	
GA	Gain @ NFO: VCE = 8 V, IC = 10 mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB		18.5 14.5 10.5	
$\|S_{21E}\|^2$	Insertion Power Gain: VCE = 8 V, IC = 25 mA	f = 2.0 GHz f = 4.0 GHz	dB		12.0 6.5	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression: VCE = 8 V, IC = 25 mA	f = 2.0 GHz f = 4.0 GHz	dBm		19.0 18.5	
$G_{1\,dB}$	1 dB Compressed Gain: VCE = 8 V, IC = 25 mA	f = 2.0 GHz f = 4.0 GHz	dB		15.0 10.5	
f_T	Gain Bandwidth Product: VCE = 8 V, IC = 25 mA		GHz		9.0	
hFE	Forward Current Transfer Ratio: VCE = 8 V, IC = 10 mA			30	150	300
ICBO	Collector Cutoff Current: VCB = 8 V		µA			0.2
IEBO	Emitter Cutoff Current: VEB = 1 V		µA			1.0
CCB	Collector Base Capacitance[2]: VCB = 8 V, f = 1 MHz		pF		0.17	

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
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	60 mA
Power Dissipation[2,3]	P_T	500 mW
Junction Temperature	T_j	200°C
Storage Temperature	T_{STG}	–65°C to 200°C

Thermal Resistance[2,4]: $\theta_{jc} = 95°C/W$

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 10.5 mW/°C for $T_{MOUNTING\ SURFACE} > 153°C$.
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.

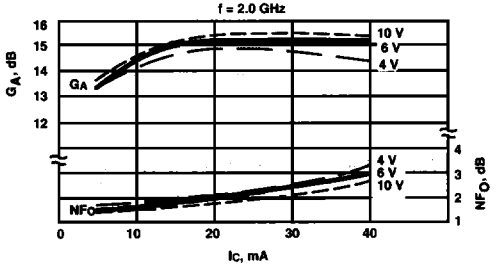
Part Number Ordering Information

Part Number	Devices Per Tray
AT-41400-GP2	10
AT-41400-GP4	100
AT-41400-GP6	up to 300

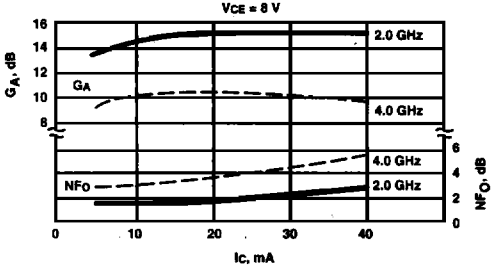
Typical Performance, $T_A = 25°C$

(unless otherwise noted)

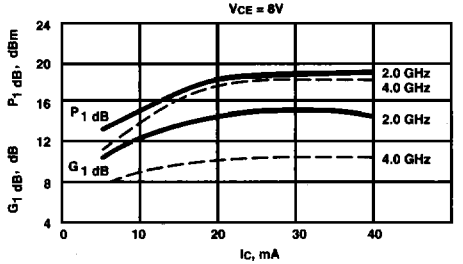
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT AND COLLECTOR VOLTAGE
f = 2.0 GHz



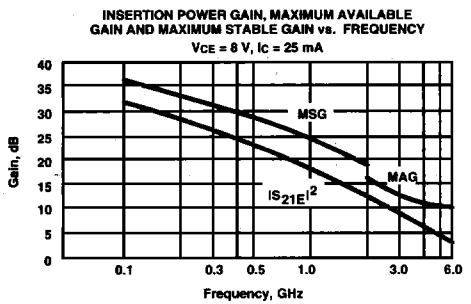
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
VCE = 8 V



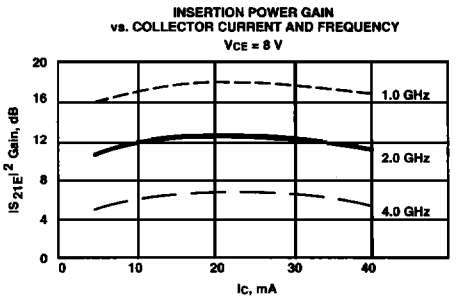
OUTPUT POWER AND 1 dB COMPRESSED GAIN vs. COLLECTOR CURRENT AND FREQUENCY
VCE = 8V



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN AND MAXIMUM STABLE GAIN vs. FREQUENCY
VCE = 8 V, IC = 25 mA



INSERTION POWER GAIN vs. COLLECTOR CURRENT AND FREQUENCY
VCE = 8 V



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	.73	–39	28.3	25.84	159	–39.2	.011	75	.94	–12
0.5	.60	–121	22.2	12.91	113	–30.2	.031	48	.61	–28
1.0	.57	–156	17.2	7.27	94	–28.0	.040	51	.50	–25
1.5	.56	–172	13.7	4.84	84	–26.4	.048	59	.47	–25
2.0	.57	176	11.4	3.71	77	–24.9	.057	66	.46	–24
2.5	.57	170	9.5	2.97	71	–23.6	.066	69	.46	–26
3.0	.60	164	8.0	2.52	64	–22.3	.077	72	.45	–28
3.5	.60	157	6.8	2.18	61	–20.9	.090	77	.47	–29
4.0	.61	152	5.5	1.89	55	–20.1	.099	79	.47	–30
4.5	.63	147	4.7	1.72	51	–18.7	.116	81	.47	–36
5.0	.63	144	3.7	1.53	46	–17.8	.129	80	.48	–40
5.5	.65	139	3.1	1.42	42	–17.0	.141	82	.49	–44
6.0	.66	136	2.1	1.28	38	–16.1	.156	83	.50	–47

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

0.1	.56	–60	31.8	39.07	152	–40.9	.009	69	.87	–18
0.5	.54	–145	23.5	15.00	104	–32.8	.023	56	.49	–28
1.0	.54	–170	18.1	8.03	90	–29.6	.033	65	.42	–23
1.5	.55	179	14.5	5.30	82	–26.9	.045	72	.41	–22
2.0	.56	170	12.1	4.04	76	–24.7	.058	75	.41	–23
2.5	.56	165	10.2	3.24	72	–23.1	.070	78	.40	–23
3.0	.58	159	8.8	2.75	65	–21.6	.083	79	.40	–25
3.5	.59	154	7.5	2.37	62	–20.4	.096	82	.41	–26
4.0	.60	149	6.3	2.06	57	–19.3	.108	83	.42	–28
4.5	.61	145	5.4	1.87	53	–18.1	.124	84	.42	–33
5.0	.62	142	4.5	1.67	49	–17.3	.136	83	.43	–36
5.5	.64	137	3.8	1.54	44	–16.5	.150	85	.42	–40
6.0	.65	134	2.9	1.40	41	–15.7	.165	84	.44	–45

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