Surface Mount Low Noise Silicon Bipolar Transistor Chip

Technical Data

AT-41411

Features

- **Low Noise Figure:**
  1.4 dB Typical at 1.0 GHz
  1.8 dB Typical at 2.0 GHz
- **High Associated Gain:**
  18.0 dB Typical at 1.0 GHz
  13.0 dB Typical at 2.0 GHz
- **High Gain-Bandwidth Product:** 7.0 GHz Typical f_T
- **Low Cost Surface Mount Plastic Package**
- **Tape-and-Reel Packaging Option Available**[1]

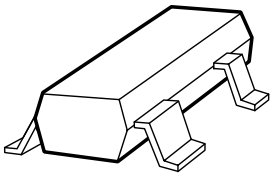
Description

Hewlett-Packard's AT-41411 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-41411 is housed in a low cost low parasitic 4 lead SOT-143 surface mount package. The SOT-143 is an industry standard and is compatible with high volume surface mount assembly techniques. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 14 emitter finger interdigitated geometry yields an intermediate sized transistor with impedances that are easy to match for low noise and moderate 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 in the 1 to 2 GHz frequency range, makes this device easy to use as a low noise amplifier.

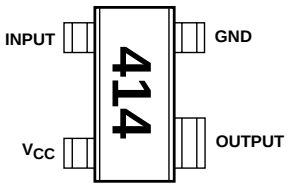
The AT-41411 bipolar transistor is fabricated using Hewlett-Packard's 10 GHz f_T Self-Aligned-Transistor (SAT) process. The die is nitride passivated for surface protection. Excellent device uniformity, performance and reliability are produced by the use of ion-implantation, self-alignment techniques, and gold metalization in the fabrication of this device.

Note:
1. Refer to "Tape-and-Reel Packaging for Semiconductor Devices".

SOT-143 Plastic



Pin Connections



AT-41411 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	50
P_T	Power Dissipation [2,3]	mW	225
T_j	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Thermal Resistance [2,4]:
$\theta_{jc} = 550°C/W$

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{CASE} = 25°C$.
3. Derate at 1.8 mW/°C for $T_C > 26°C$.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

Part Number Ordering Information

Part Number	Increment	Comments
AT-41411-TR1	3000	Reel
AT-41411-BLK	100	Bulk

Note: For more information, see "Tape and Reel Packaging for Semiconductor Devices".

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, $I_C = 20$ mA	f = 1.0 GHz f = 2.0 GHz	dB	14.5	16.5 11.0	
$P_{1\ dB}$	Power Output @ 1 dB Gain Compression $V_{CE} = 8$ V, $I_C = 20$ mA	f = 2.0 GHz	dBm		17.0	
$G_{1\ dB}$	1 dB Compressed Gain; $V_{CE} = 8$ V, $I_C = 20$ mA	f = 2.0 GHz	dB		13.0	
NF_O	Optimum Noise Figure: $V_{CE} = 8$ V, $I_C = 10$ mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB		1.4 1.8 3.5	
G_A	Gain @ NF_O; $V_{CE} = 8$ V, $I_C = 10$ mA	f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	dB		18.0 13.0 9.0	
f_T	Gain Bandwidth Product: $V_{CE} = 8$ V, $I_C = 20$ mA		GHz		7.0	
h_{FE}	Forward Current Transfer Ratio; $V_{CE} = 8$ V, $I_C = 10$ 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			1.0

Notes:
1. Refer to PACKAGING Section, "Tape-and-Reel Packaging for Semiconductor Devices."

AT-41411 Typical Performance, T_A = 25°C

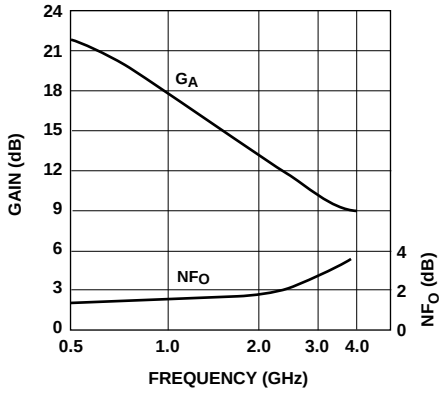


Figure 1. Noise Figure and Associated Gain vs. Frequency. V_{CE} = 8 V, I_C=10mA.

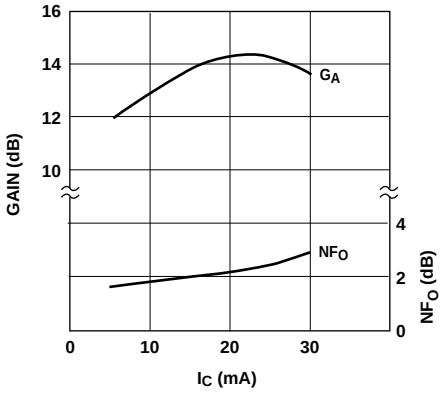


Figure 2. Optimum Noise Figure and Associated Gain vs. Collector Current and Frequency. V_{CE} = 8 V, f = 2.0 GHz.

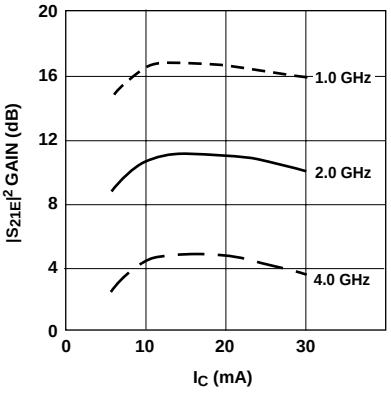


Figure 3. Insertion Power Gain vs. Collector Current and Frequency. V_{CE} = 8 V.

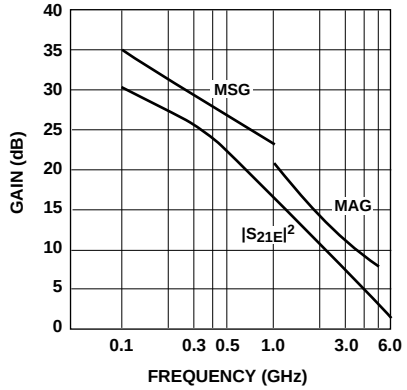


Figure 4. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{CE} = 8 V, I_C = 20 mA.

AT-41411 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} Mag.	S_{11} Ang.	S_{21} dB	S_{21} Mag.	S_{21} Ang.	S_{12} dB	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
0.1	.85	-30	27.3	23.20	158	-37.7	.013	64	.93	-11
0.5	.58	-112	21.7	12.18	109	-29.1	.035	44	.62	-30
1.0	.49	-156	16.5	6.70	85	-27.2	.044	43	.50	-33
1.5	.49	178	13.2	4.58	71	-25.0	.056	47	.46	-36
2.0	.50	160	10.8	3.45	59	-23.4	.068	47	.45	-41
2.5	.53	153	9.0	2.82	53	-22.5	.075	56	.43	-43
3.0	.55	142	7.5	2.37	43	-21.0	.089	54	.43	-53
3.5	.56	133	6.1	2.02	33	-19.8	.102	52	.44	-63
4.0	.56	121	4.9	1.76	23	-18.8	.115	49	.46	-73

AT-41411 Typical Scattering Parameters,

Common Emitter, $Z_O = 50\,\Omega$, $T_A = 25°C$, $V_{CE} = 8\,V$, $I_C = 20\,mA$

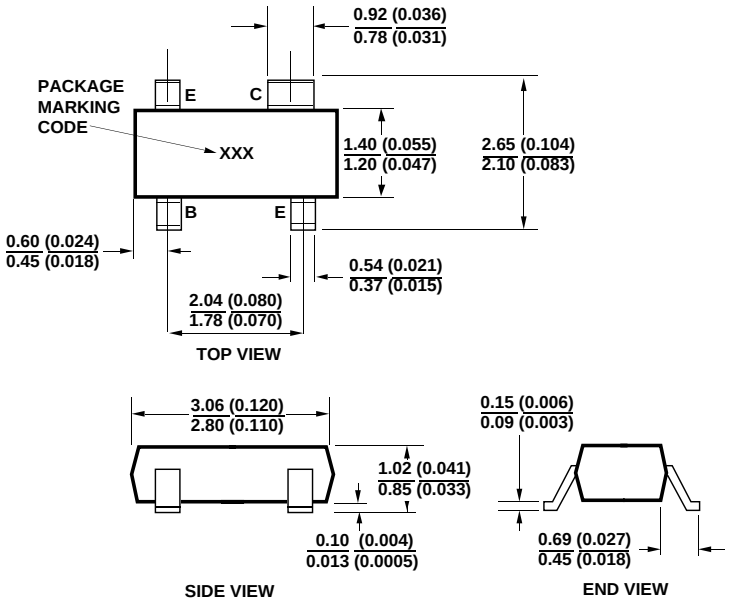
Freq. GHz	S_{11} Mag.	S_{11} Ang.	S_{21} dB	S_{21} Mag.	S_{21} Ang.	S_{12} dB	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
0.1	.65	-46	30.4	33.07	150	-40.0	.010	59	.89	-15
0.5	.46	-137	22.4	13.21	100	-32.0	.025	56	.57	-26
1.0	.43	-175	16.7	6.85	80	-28.4	.038	58	.52	-29
1.5	.44	163	13.3	4.63	67	-26.4	.048	61	.51	-32
2.0	.47	148	10.8	3.47	56	-24.2	.062	61	.50	-37
2.5	.50	140	9.0	2.82	50	-22.9	.071	60	.47	-39
3.0	.53	132	7.5	2.36	40	-20.7	.092	61	.46	-48
3.5	.55	122	6.1	2.02	30	-19.6	.105	57	.45	-60
4.0	.56	112	4.8	1.74	19	-18.3	.122	53	.45	-73

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

AT-41411 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	1.3	.12	4	0.17
0.5	1.3	.10	23	0.17
1.0	1.4	.07	57	0.16
2.0	1.8	.09	-158	0.16
4.0	3.5	.31	-87	0.38

SOT-143 Plastic Dimensions



DIMENSIONS ARE IN MILLIMETERS (INCHES)