

Up to 6 GHz Low Noise Silicon Bipolar Transistor

Technical Data

AT-41486

Features

- **Low Noise Figure:**
1.4 dB Typical at 1.0 GHz
1.7 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:** 8.0 GHz Typical f_T
- **Surface Mount Plastic Package**
- **Tape-and-Reel Packaging Option Available⁽¹⁾**

Note:

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

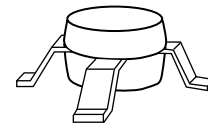
Description

Hewlett-Packard's AT-41486 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-41486 is housed in a low cost surface mount .085" diameter plastic package. The 4 micron

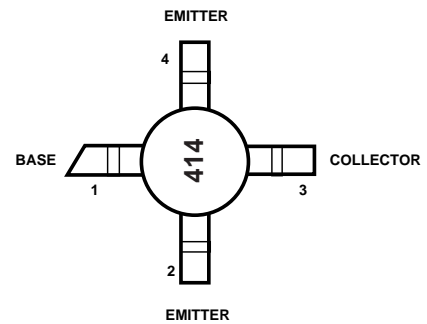
emitter-to-emitter pitch enables this transistor to be used in many different functions. The 14 emitter finger interdigitated geometry yields an intermediate sized transistor with impedances that are easy to match for low noise and moderate power applications. Applications include use in wireless systems as an LNA, gain stage, buffer, oscillator, and mixer. An optimum noise match near 50Ω at 900 MHz, makes this device easy to use as a low noise amplifier.

The AT-41486 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.

86 Plastic Package



Pin Connections



AT-41486 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 | 60 |
| P _T | Power Dissipation ^[2,3] | mW | 500 |
| T _j | Junction Temperature | °C | 150 |
| T _{STG} | Storage Temperature | °C | -65 to 150 |

Thermal Resistance^[2,4]:

$$\theta_{jc} = 165^{\circ}\text{C}/\text{W}$$

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 6 mW/°C for T_C > 68°C.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

Part Number Ordering Information

| Part Number | Increment | Comments |
|--------------|-----------|----------|
| AT-41486-TR1 | 1000 | Reel |
| AT-41486-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 | Units | Min. | Typ. | Max. |
|---------------------------------|---|---|------|-----------------------------|------|
| S _{21E} ² | Insertion Power Gain; V _{CE} = 8 V, I _C = 25 mA | f = 2.0 GHz f = 4.0 GHz | dB | 17.5 11.5 | |
| P _{1dB} | Power Output @ 1 dB Gain Compression V _{CE} = 8 V, I _C = 25 mA | f = 2.0 GHz | dBm | 18.0 | |
| G _{1dB} | 1 dB Compressed Gain; V _{CE} = 8 V, I _C = 25 mA | f = 2.0 GHz | dB | 13.5 | |
| 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 1.7 3.0 | 1.8 |
| G _A | Gain @ NFO; V _{CE} = 8 V, I _C = 10 mA | f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz | dB | 17.0 18.0 13.0 9.0 | |
| f _T | Gain Bandwidth Product: V _{CE} = 8 V, I _C = 25 mA | | GHz | 8.0 | |
| h _{FE} | Forward Current Transfer Ratio; V _{CE} = 8 V, I _C = 10 mA | | — | 30 | 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 |
| C _{CB} | Collector Base Capacitance ^[1] : V _{CB} = 8 V, f = 1 MHz | | pF | 0.25 | |

Note:

1. For this test, the emitter is grounded.

AT-41486 Typical Performance, $T_A = 25^\circ\text{C}$

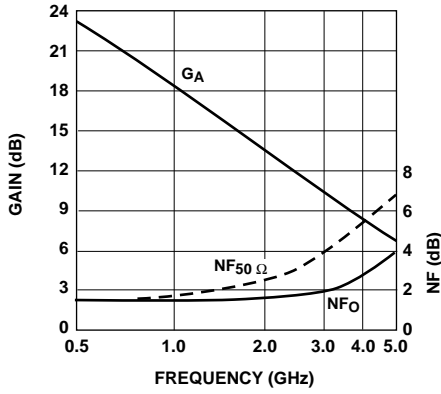


Figure 1. Noise Figure and Associated Gain vs. Frequency.
 $V_{CE} = 8\text{ V}$, $I_C = 10\text{ mA}$.

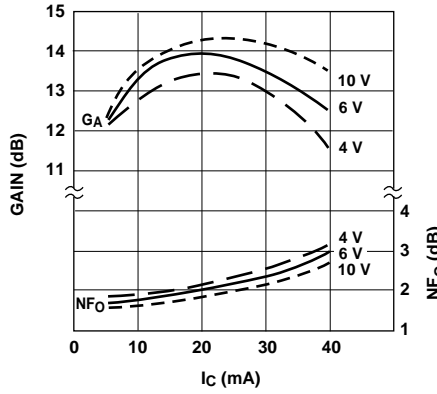


Figure 2. Optimum Noise Figure and Associated Gain vs. Collector Current and Collector Voltage. $f = 2.0\text{ GHz}$.

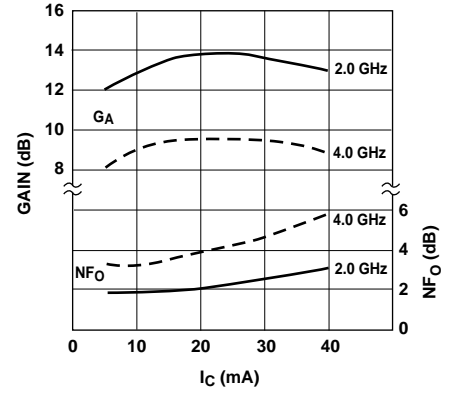


Figure 3. Optimum Noise Figure and Associated Gain vs. Collector Current and Frequency. $V_{CE} = 8\text{ V}$.

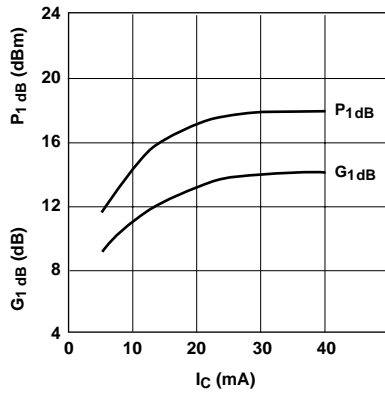


Figure 4. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency. $V_{CE} = 8\text{ V}$, $f = 2.0\text{ GHz}$.

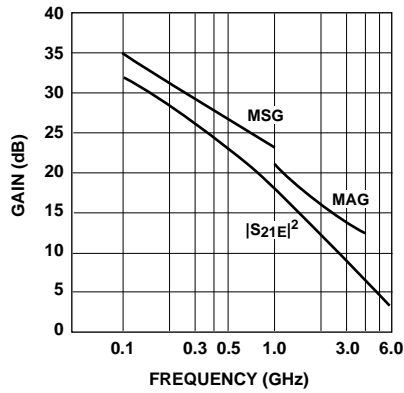


Figure 5. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. $V_{CE} = 8\text{ V}$, $I_C = 25\text{ mA}$.

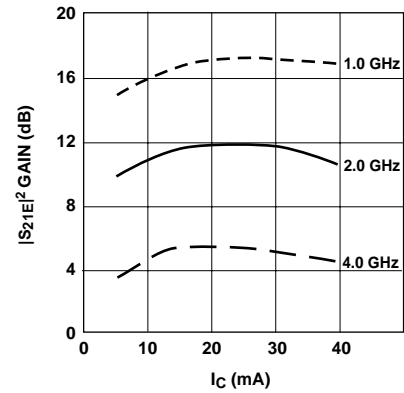


Figure 6. Insertion Power Gain vs. Collector Current and Frequency. $V_{CE} = 8\text{ V}$.

AT-41486 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 | .74 | -38 | 28.1 | 25.46 | 157 | -39.6 | .011 | 68 | .94 | -12 |
| 0.5 | .59 | -127 | 22.0 | 12.63 | 107 | -30.2 | .031 | 47 | .60 | -29 |
| 1.0 | .56 | -168 | 16.8 | 6.92 | 84 | -27.7 | .041 | 46 | .49 | -29 |
| 1.5 | .57 | 169 | 13.5 | 4.72 | 69 | -26.2 | .049 | 49 | .45 | -32 |
| 2.0 | .62 | 152 | 11.1 | 3.61 | 56 | -24.8 | .058 | 43 | .42 | -39 |
| 2.5 | .63 | 142 | 9.3 | 2.91 | 47 | -23.4 | .068 | 52 | .40 | -42 |
| 3.0 | .64 | 130 | 7.6 | 2.41 | 37 | -22.2 | .078 | 52 | .39 | -50 |
| 3.5 | .68 | 122 | 6.3 | 2.06 | 26 | -20.6 | .093 | 51 | .37 | -60 |
| 4.0 | .71 | 113 | 5.1 | 1.80 | 16 | -19.5 | .106 | 48 | .35 | -70 |
| 4.5 | .74 | 105 | 4.0 | 1.59 | 7 | -18.0 | .125 | 48 | .35 | -84 |
| 5.0 | .77 | 99 | 3.1 | 1.42 | -4 | -17.2 | .139 | 43 | .35 | -98 |
| 5.5 | .79 | 93 | 2.0 | 1.27 | -13 | -16.3 | .153 | 38 | .35 | -114 |
| 6.0 | .81 | 87 | 1.1 | 1.13 | -22 | -15.4 | .170 | 34 | .35 | -131 |

AT-41486 Typical Scattering Parameters,

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

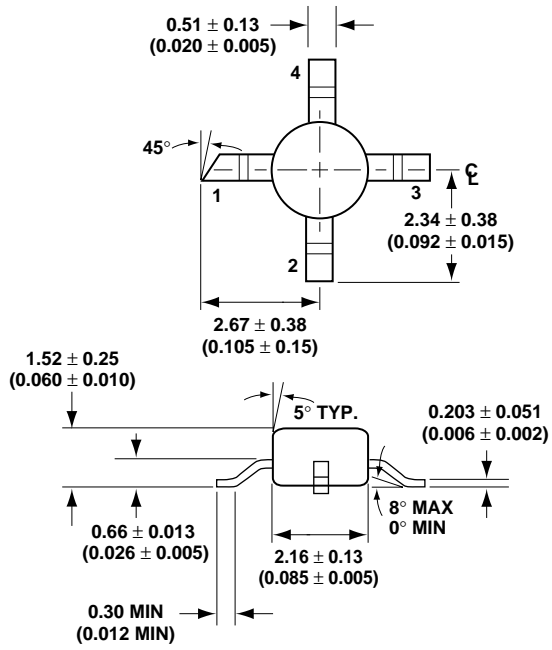
| Freq. GHz | S_{11} | | dB | S_{21} | | dB | S_{12} | | S_{22} | |
|--------------|----------|------|------|----------|------|-------|----------|------|----------|------|
| | Mag. | Ang. | | Mag. | Ang. | | Mag. | Ang. | Mag. | Ang. |
| 0.1 | .50 | -75 | 32.0 | 40.01 | 142 | -41.3 | .009 | 54 | .85 | -17 |
| 0.5 | .55 | -158 | 23.2 | 14.38 | 97 | -34.1 | .020 | 48 | .51 | -24 |
| 1.0 | .57 | 177 | 17.5 | 7.50 | 78 | -29.9 | .032 | 61 | .46 | -24 |
| 1.5 | .57 | 161 | 14.1 | 5.07 | 65 | -27.3 | .043 | 62 | .44 | -28 |
| 2.0 | .59 | 148 | 11.5 | 3.75 | 53 | -24.8 | .058 | 59 | .43 | -35 |
| 2.5 | .61 | 139 | 9.6 | 3.02 | 45 | -22.9 | .072 | 58 | .40 | -41 |
| 3.0 | .65 | 128 | 8.0 | 2.52 | 34 | -21.6 | .083 | 57 | .38 | -49 |
| 3.5 | .70 | 121 | 6.7 | 2.17 | 24 | -20.1 | .099 | 56 | .36 | -59 |
| 4.0 | .74 | 113 | 5.7 | 1.92 | 14 | -18.8 | .115 | 52 | .34 | -72 |
| 4.5 | .78 | 107 | 4.7 | 1.72 | 3 | -17.6 | .132 | 47 | .32 | -87 |
| 5.0 | .78 | 102 | 3.7 | 1.53 | -8 | -16.6 | .149 | 42 | .31 | -106 |
| 5.5 | .78 | 96 | 2.7 | 1.36 | -19 | -15.4 | .169 | 36 | .31 | -125 |
| 6.0 | .76 | 91 | 1.6 | 1.21 | -29 | -14.5 | .188 | 31 | .33 | -144 |

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

AT-41486 Noise Parameters: $V_{CE} = 8 \text{ V}, I_C = 10 \text{ mA}$

| Freq. GHz | NF_0 dB | Γ_{opt} | | $R_N/50$ |
|--------------|--------------|----------------|------|----------|
| | | Mag | Ang | |
| 0.1 | 1.3 | .12 | 3 | 0.17 |
| 0.5 | 1.3 | .10 | 16 | 0.17 |
| 1.0 | 1.4 | .04 | 43 | 0.16 |
| 2.0 | 1.7 | .12 | -145 | 0.16 |
| 4.0 | 3.0 | .44 | -99 | 0.40 |

86 Plastic Package Dimensions



DIMENSIONS ARE IN MILLIMETERS (INCHES)