

**Ultra High Frequency Matched Pair Transistors**

The HFA3134 and HFA3135 are Ultra High Frequency Transistor pairs that are fabricated with Intersil Corporation's complementary bipolar UHF-1X process. The NPN transistors exhibit an  $f_T$  of 8.5GHz, while the PNP transistors have an  $f_T$  of 7GHz. Both types exhibit low noise, making them ideal for high frequency amplifier and mixer applications.

Both arrays are matched high frequency transistor pairs. The matching simplifies DC bias problems and it minimizes imbalances in differential amplifier configurations. Their high  $f_T$  enables the design of UHF amplifiers which exhibit exceptional stability.

**Ordering Information**

PART NUMBER (BRAND)	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HFA3134IH96 (H04)	-40 to 85	6 Ld SOT23	P6.064
HFA3135IH96 (H05)	-40 to 85	6 Ld SOT23	P6.064

**Features**

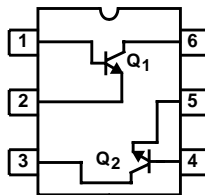
- NPN Transistor ( $f_T$ ) . . . . . 8.5GHz
- NPN Current Gain ( $h_{FE}$ ) . . . . . 100
- NPN Noise Figure (50Ω) at 1.0GHz . . . . . 2.6dB
- PNP Transistor ( $f_T$ ) . . . . . 7GHz
- PNP Current Gain ( $h_{FE}$ ) . . . . . 57
- PNP Noise Figure (50Ω) at 900MHz . . . . . 4.6dB
- Small Package (EIAJ-SC74 Compliant) . . . . . SOT23-6

**Applications**

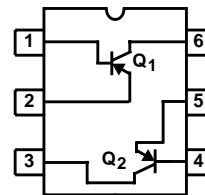
- VHF/UHF Amplifiers
- VHF/UHF Mixers
- IF Converters
- Synchronous Detectors

**Pinouts**

**HFA3134 (SOT23) TOP VIEW**



**HFA3135 (SOT23) TOP VIEW**



# HFA3134, HFA3135

## Absolute Maximum Ratings

Collector to Emitter Voltage ( $R_B \leq 10k\Omega$ to GND) .....	11V
Collector to Base Voltage (Open Emitter) .....	12V
Emitter to Base Voltage (Reverse Bias) .....	4.5V
Collector Current .....	14mA at $T_J = 150^\circ\text{C}$
	26mA at $T_J = 125^\circ\text{C}$
Base Current (Note 2) .....	1.7mA
ESD Rating	
Human Body Model .....	400V
(Per MIL-STD-883 Method 3015.7)	

## Thermal Information

Thermal Resistance (Typical, Note 1)	$\theta_{JA}$ ( $^\circ\text{C}/\text{W}$ )
SOT23-6 Package .....	350
Maximum Junction Temperature (Die) .....	175 $^\circ\text{C}$
Maximum Junction Temperature (Plastic Package) .....	150 $^\circ\text{C}$
Maximum Storage Temperature Range .....	-65 $^\circ\text{C}$ to 150 $^\circ\text{C}$
Maximum Lead Temperature .....	300 $^\circ\text{C}$
(Soldering 10s, Lead Tips Only)	

## Operating Conditions

Temperature Range .....

-40 $^\circ\text{C}$  to 85 $^\circ\text{C}$

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

### NOTE:

- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.
- If a transistor is used in a diode configuration, the collector must be connected to the base to avoid exceeding the maximum base current specification.

## Electrical Specifications $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	TEST CONDITIONS	TEST LEVEL (NOTE 3)	MIN	TYP	MAX	UNITS
<b>DC CHARACTERISTICS FOR HFA3134 (NPN)</b>							
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}$ , $I_E = 0$	A	12	21	-	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 100\mu\text{A}$ , $I_B = 0$	A	4	9	-	V
	$V_{(BR)CER}$	$I_C = 100\mu\text{A}$ , $R_B = 10k\Omega$	A	11	17	-	V
Emitter-to-Base Breakdown Voltage (Note 4)	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}$ , $I_C = 0$	B	-	6	-	V
Collector-Cutoff-Current	$I_{CEO}$	$V_{CE} = 6\text{V}$ , $I_B = 0$	A	-5	-	5	nA
Collector-Cutoff-Current	$I_{CBO}$	$V_{CB} = 8\text{V}$ , $I_E = 0$	A	-5	-	5	nA
Emitter-Cutoff-Current (Note 5)	$I_{EBO}$	$V_{EB} = 1\text{V}$ , $I_C = 0$	B	-	1	-	pA
Collector-to-Collector Leakage			C	-	1	-	nA
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = 10\text{mA}$ , $I_B = 1\text{mA}$	A	-	95	250	mV
Base-to-Emitter Voltage (Note 5)	$V_{BE}$	$I_C = 10\text{mA}$ , $V_{CE} = 2\text{V}$	A	-	780	1000	mV
Q <sub>1</sub> to Q <sub>2</sub> Base-to-Emitter Voltage Match (Note 5)	$\Delta V_{BE}$	$I_C = 10\text{mA}$ , $V_{CE} = 2\text{V}$	A	-	1.2	6	mV
		$I_C = 1\text{mA}$ , $V_{CE} = 2\text{V}$	A	-	1.0	6	mV
		$I_C = 0.1\text{mA}$ , $V_{CE} = 2\text{V}$	A	-	0.7	6	mV
Base-to-Emitter Voltage Drift		$I_C = 10\text{mA}$	C	-	-1.5	-	mV/ $^\circ\text{C}$
DC Forward-Current Transfer Ratio (Note 5)	$h_{FE}$	$I_C = 10\text{mA}$ , $V_{CE} = 2\text{V}$	A	48	80	200	
		$I_C = 1\text{mA}$ , $V_{CE} = 2\text{V}$	A	48	87	200	
		$I_C = 0.1\text{mA}$ , $V_{CE} = 2\text{V}$	A	48	90	200	
		$I_C = 10\text{mA}$ , $V_{CE} = 5\text{V}$	A	48	96	200	
		$I_C = 1\text{mA}$ , $V_{CE} = 5\text{V}$	A	48	96	200	
		$I_C = 0.1\text{mA}$ , $V_{CE} = 5\text{V}$	A	48	100	200	
Q <sub>1</sub> to Q <sub>2</sub> Current Transfer Ratio Match	$\Delta h_{FE}$	$1\text{mA} \leq I_C \leq 10\text{mA}$ , $1\text{V} \leq V_{CE} \leq 5\text{V}$	A	-	2	8	%
Early Voltage	$V_A$	$I_C = 1\text{mA}$ , $\Delta V_{CE} = 3\text{V}$	A	20	30	-	V

## HFA3134, HFA3135

### Electrical Specifications $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	TEST CONDITIONS	TEST LEVEL (NOTE 3)	MIN	TYP	MAX	UNITS
<b>DYNAMIC CHARACTERISTICS FOR HFA3134 (NPN)</b>							
Noise Figure	NF	$f = 1.0\text{GHz}, I_C = 10\text{mA}, 1\text{V} \leq V_{CE} \leq 5\text{V}, Z_S = 50\Omega$	B	-	2.4	-	dB
		$f = 1.0\text{GHz}, I_C = 1\text{mA}, 1\text{V} \leq V_{CE} \leq 5\text{V}, Z_S = 50\Omega$	B	-	2.6	-	dB
Current Gain-Bandwidth Product (Note 5)	$f_T$	$I_C = 10\text{mA}, V_{CE} = 5\text{V}$	B	-	8.5	-	GHz
		$I_C = 1\text{mA}, V_{CE} = 5\text{V}$	B	-	3	-	GHz
Power Gain-Bandwidth Product	$f_{MAX}$	$I_C = 10\text{mA}, V_{CE} = 5\text{V}$	B	-	7.5	-	GHz
Base-to-Emitter Capacitance		$V_{BE} = -0.5\text{V}$	B	-	600	-	fF
Collector-to-Base Capacitance		$V_{CB} = 3\text{V}$	B	-	500	-	fF

### Electrical Specifications $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	TEST CONDITIONS	TEST LEVEL (NOTE 3)	MIN	TYP	MAX	UNITS
<b>DC CHARACTERISTICS FOR HFA3135 (PNP)</b>							
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = -10\mu\text{A}, I_E = 0$	A	12	21	-	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = -100\mu\text{A}, I_B = 0$	A	4	14	-	V
	$V_{(BR)CER}$	$I_C = -100\mu\text{A}, R_B = 10\text{k}\Omega$	A	11	23	-	V
Emitter-to-Base Breakdown Voltage (Note 4)	$V_{(BR)EBO}$	$I_E = -10\mu\text{A}, I_C = 0$	B	-	5	-	V
Collector-Cutoff-Current	$I_{CEO}$	$V_{CE} = -6\text{V}, I_B = 0$	A	-5	-	5	nA
Collector-Cutoff-Current	$I_{CBO}$	$V_{CB} = -8\text{V}, I_E = 0$	A	-5	-	5	nA
Emitter-Cutoff-Current	$I_{EBO}$	$V_{EB} = -1\text{V}, I_C = 0$	B	-	TBD	-	pA
Collector-to-Collector Leakage			B	-	1	-	nA
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = -10\text{mA}, I_B = -1\text{mA}$	A	-	150	250	mV
Base-to-Emitter Voltage	$V_{BE}$	$I_C = -10\text{mA}, V_{CE} = -2\text{V}$	A	-	850	1000	mV
Q <sub>1</sub> to Q <sub>2</sub> Base-to-Emitter Voltage Match	$\Delta V_{BE}$	$I_C = -10\text{mA}, V_{CE} = -2\text{V}$	A	-	1	6	mV
		$I_C = -1\text{mA}, V_{CE} = -2\text{V}$	A	-	1	6	mV
		$I_C = -0.1\text{mA}, V_{CE} = -2\text{V}$	A	-	2	6	mV
DC Forward-Current Transfer Ratio	$h_{FE}$	$I_C = -10\text{mA}, V_{CE} = -2\text{V}$	A	15	40	125	
		$I_C = -1\text{mA}, V_{CE} = -2\text{V}$	A	15	47	125	
		$I_C = -0.1\text{mA}, V_{CE} = -2\text{V}$	A	15	52	125	
		$I_C = -10\text{mA}, V_{CE} = -5\text{V}$	A	15	47	125	
		$I_C = -1\text{mA}, V_{CE} = -5\text{V}$	A	15	53	125	
		$I_C = -0.1\text{mA}, V_{CE} = -5\text{V}$	A	15	57	125	
Q <sub>1</sub> to Q <sub>2</sub> Current Gain Match	$\Delta h_{FE}$	$-1\text{mA} \leq I_C \leq -10\text{mA}, -1\text{V} \leq V_{CE} \leq -5\text{V}$	A	-	1	8	%
Early Voltage	$V_A$	$I_C = -1\text{mA}, \Delta V_{CE} = -3\text{V}$	A	15	24	-	V
Base-to-Emitter Voltage Drift		$I_C = -10\text{mA}$	C	-	-1.4	-	mV/ $^\circ\text{C}$

# HFA3134, HFA3135

## Electrical Specifications $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	TEST CONDITIONS	TEST LEVEL (NOTE 3)	MIN	TYP	MAX	UNITS
<b>DYNAMIC CHARACTERISTICS FOR HFA3135 (PNP)</b>							
Noise Figure	NF	$f = 900\text{MHz}, I_C = -10\text{mA}, -1\text{V} \leq V_{CE} \leq -5\text{V}, Z_S = 50\Omega$	B	-	5.2	-	dB
		$f = 900\text{MHz}, I_C = -1\text{mA}, -1\text{V} \leq V_{CE} \leq -5\text{V}, Z_S = 50\Omega$	B	-	4.6	-	dB
Current Gain-Bandwidth Product	$f_T$	$I_C = -10\text{mA}, V_{CE} = -5\text{V}$	B	-	7	-	GHz
Power Gain-Bandwidth Product	$f_{MAX}$	$I_C = -10\text{mA}, V_{CE} = -5\text{V}$	B	-	TBD	-	GHz
Base-to-Emitter Capacitance		$V_{BE} = 0.5\text{V}$	B	-	550	-	fF
Collector-to-Base Capacitance		$V_{CB} = -3\text{V}$	B	-	400	-	fF

### NOTES:

- Test Level: A. Production Tested; B. Typical or Guaranteed Limit Based on Characterization; C. Design Typical for Information Only.
- Measuring  $V_{EBO}$  can degrade the transistor  $h_{FE}$  and  $h_{FE}$  match.
- See Typical Performance Curves for more information.

## Typical Performance Curves $T_A = 25^\circ\text{C}$ , Unless Otherwise Specified

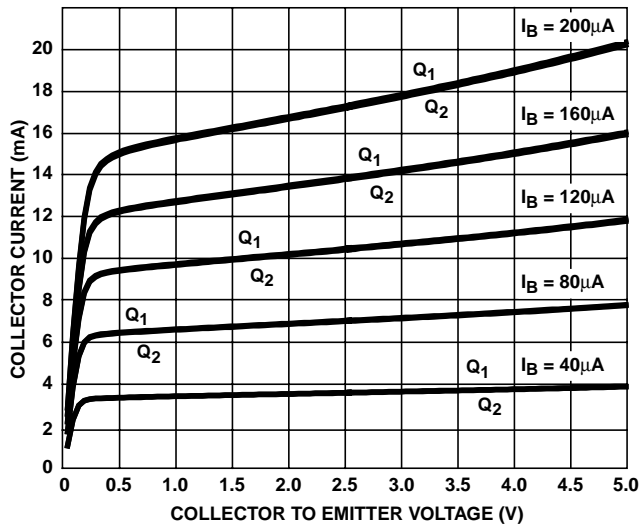


FIGURE 1. NPN COLLECTOR CURRENT vs COLLECTOR TO EMITTER VOLTAGE

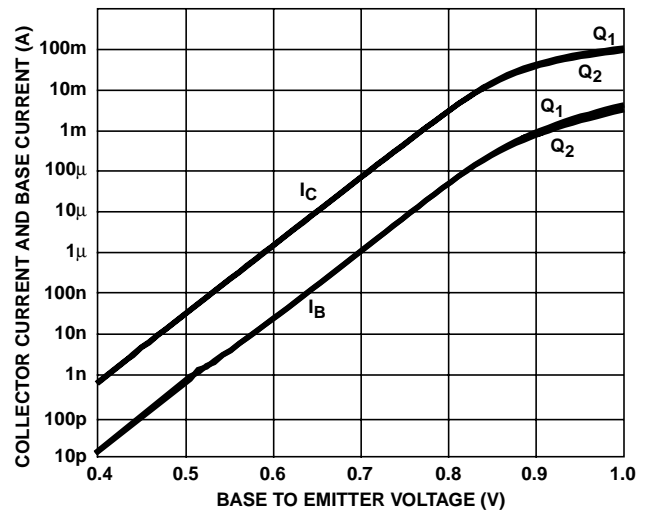


FIGURE 2. NPN COLLECTOR AND BASE CURRENTS vs BASE TO EMITTER VOLTAGE

**Typical Performance Curves**  $T_A = 25^\circ\text{C}$ , Unless Otherwise Specified (Continued)

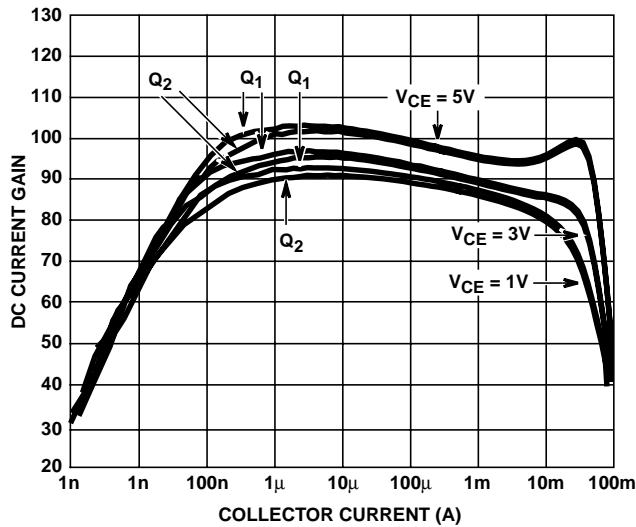


FIGURE 3. NPN DC CURRENT GAIN vs COLLECTOR CURRENT

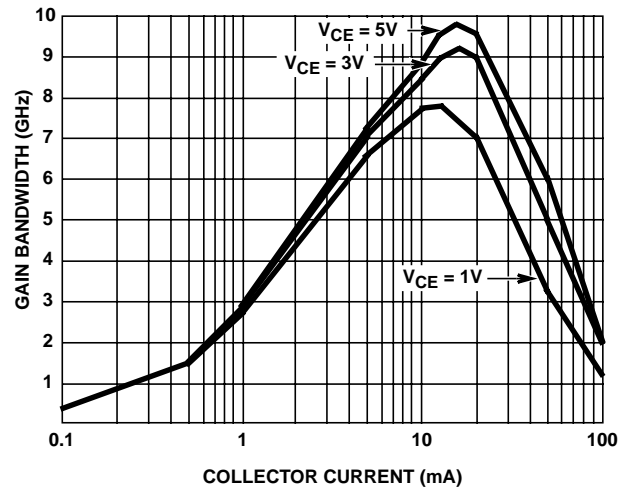


FIGURE 4. NPN GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT

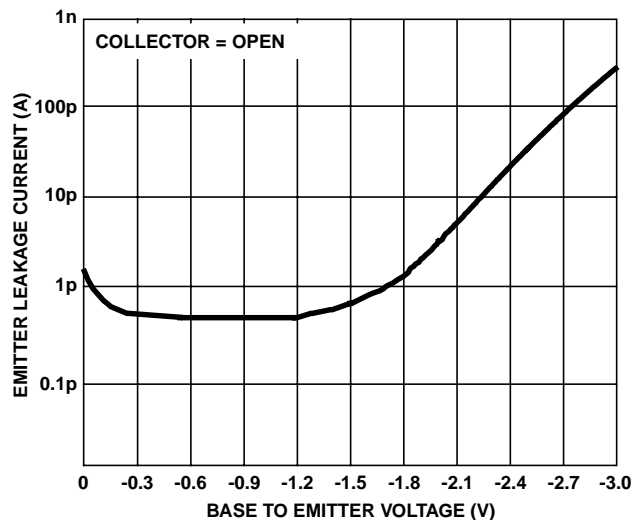


FIGURE 5. NPN EMITTER CUTOFF CURRENT vs BASE TO EMITTER VOLTAGE

All Intersil semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.

*Intersil semiconductor products are sold by description only. Intersil Corporation reserves the right to make changes in circuit design and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that data sheets are current before placing orders. Information furnished by Intersil is believed to be accurate and reliable. However, no responsibility is assumed by Intersil or its subsidiaries for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Intersil or its subsidiaries.*

For information regarding Intersil Corporation and its products, see web site [www.intersil.com](http://www.intersil.com)

**Sales Office Headquarters**

**NORTH AMERICA**  
Intersil Corporation  
P. O. Box 883, Mail Stop 53-204  
Melbourne, FL 32902  
TEL: (321) 724-7000  
FAX: (321) 724-7240

**EUROPE**  
Intersil SA  
Mercure Center  
100, Rue de la Fusee  
1130 Brussels, Belgium  
TEL: (32) 2.724.2111  
FAX: (32) 2.724.22.05

**ASIA**  
Intersil (Taiwan) Ltd.  
7F-6, No. 101 Fu Hsing North Road  
Taipei, Taiwan  
Republic of China  
TEL: (886) 2 2716 9310  
FAX: (886) 2 2715 3029