

## 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<br>(BRAND)         | TEMP.<br>RANGE (°C) | PACKAGE                               | PKG.<br>DWG. # |
|--------------------------------|---------------------|---------------------------------------|----------------|
| HFA3134IH96<br>(04/70)         | -40 to 85           | 6 Ld SOT23<br>Tape and Reel           | P6.064         |
| HFA3134IHZ96<br>(4Z/Z7) (Note) | -40 to 85           | 6 Ld SOT23<br>Tape and Reel (Pb-free) | P6.064         |
| HFA3135IH96<br>(05/90)         | -40 to 85           | 6 Ld SOT23<br>Tape and Reel           | P6.064         |
| HFA3135IHZ96<br>(5Z/9Z) (Note) | -40 to 85           | 6 Ld SOT23<br>Tape and Reel (Pb-free) | P6.064         |

NOTE: Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

## Features

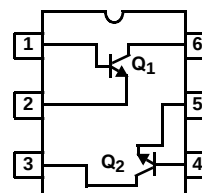
- NPN Transistor ( $f_T$ ) ..... 8.5GHz
- NPN Current Gain ( $h_{FE}$ ) ..... 100
- NPN Noise Figure (50Ω) at 1.0GHz ..... 2.6dB
- PNP Transistor ( $f_T$ ) ..... 7GHz
- PNP Current Gain ( $h_{FE}$ ) ..... 57
- PNP Noise Figure (50Ω) at 900MHz ..... 4.6dB
- Small Package (EIAJ-SC74 Compliant) ..... SOT23-6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

## Applications

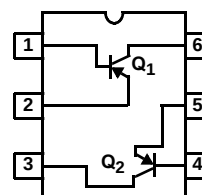
- VHF/UHF Amplifiers
- VHF/UHF Mixers
- IF Converters
- Synchronous Detectors

## Pinouts

**HFA3134  
(SOT23)  
TOP VIEW**



**HFA3135  
(SOT23)  
TOP VIEW**





## HFA3134, HFA3135

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

| PARAMETER                                        | SYMBOL           | TEST CONDITIONS                                                                                          | (NOTE 3)<br>TEST<br>LEVEL | MIN | TYP | MAX | UNITS |
|--------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------|---------------------------|-----|-----|-----|-------|
| <b>DYNAMIC CHARACTERISTICS FOR HFA3134 (NPN)</b> |                  |                                                                                                          |                           |     |     |     |       |
| Noise Figure                                     | NF               | $f = 1.0\text{GHz}$ , $I_C = 10\text{mA}$ ,<br>$1\text{V} \leq V_{CE} \leq 5\text{V}$ , $Z_S = 50\Omega$ | B                         | -   | 2.4 | -   | dB    |
|                                                  |                  | $f = 1.0\text{GHz}$ , $I_C = 1\text{mA}$ ,<br>$1\text{V} \leq V_{CE} \leq 5\text{V}$ , $Z_S = 50\Omega$  | B                         | -   | 2.6 | -   | dB    |
| Current Gain-Bandwidth Product<br>(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                     | $f_{\text{MAX}}$ | $I_C = 10\text{mA}$ , $V_{CE} = 5\text{V}$                                                               | 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                                                                        | (NOTE 3)<br>TEST<br>LEVEL | 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            | $\Delta h_{FE}$ | $-1\text{mA} \leq I_C \leq -10\text{mA}$ ,<br>$-1\text{V} \leq V_{CE} \leq -5\text{V}$ | 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 $T_A = 25^\circ\text{C}$ (Continued)

| PARAMETER                                        | SYMBOL           | TEST CONDITIONS                                                                                             | (NOTE 3)<br>TEST<br>LEVEL | MIN | TYP | MAX | UNITS |
|--------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------|---------------------------|-----|-----|-----|-------|
| <b>DYNAMIC CHARACTERISTICS FOR HFA3135 (PNP)</b> |                  |                                                                                                             |                           |     |     |     |       |
| Noise Figure                                     | NF               | $f = 900\text{MHz}$ , $I_C = -10\text{mA}$ ,<br>$-1\text{V} \leq V_{CE} \leq -5\text{V}$ , $Z_S = 50\Omega$ | B                         | -   | 5.2 | -   | dB    |
|                                                  |                  | $f = 900\text{MHz}$ , $I_C = -1\text{mA}$ ,<br>$-1\text{V} \leq V_{CE} \leq -5\text{V}$ , $Z_S = 50\Omega$  | 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                     | $f_{\text{MAX}}$ | $I_C = -10\text{mA}$ , $V_{CE} = -5\text{V}$                                                                | 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

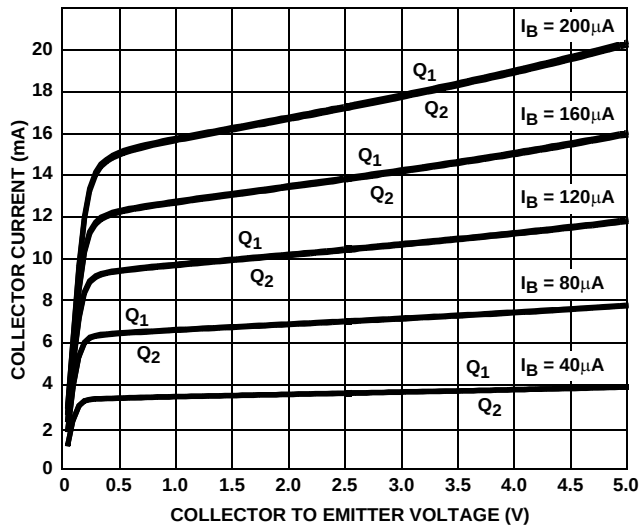


FIGURE 1. NPN COLLECTOR CURRENT vs COLLECTOR TO EMITTER VOLTAGE

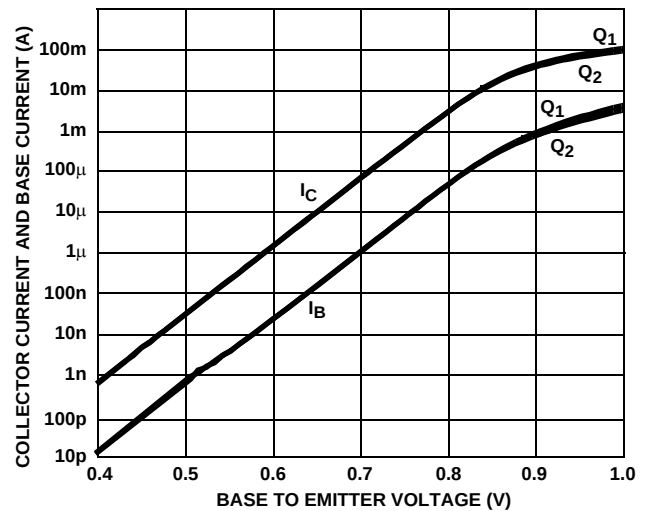


FIGURE 2. NPN COLLECTOR AND BASE CURRENTS vs BASE TO EMITTER VOLTAGE

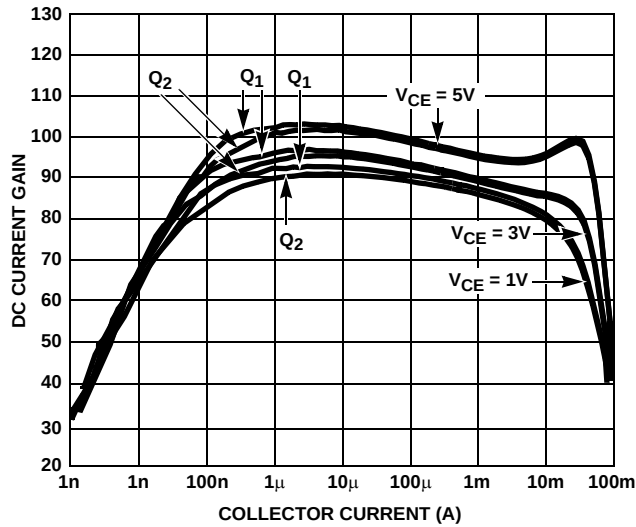
**Typical Performance Curves**  $T_A = 25^\circ\text{C}$ , Unless Otherwise Specified (Continued)

FIGURE 3. NPN DC CURRENT GAIN vs COLLECTOR CURRENT

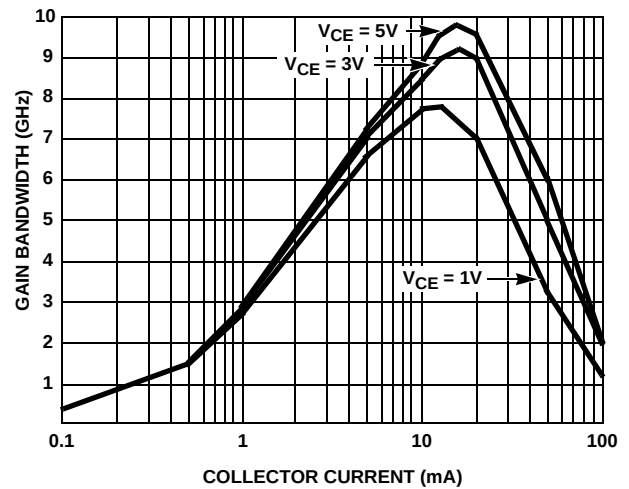


FIGURE 4. NPN GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT

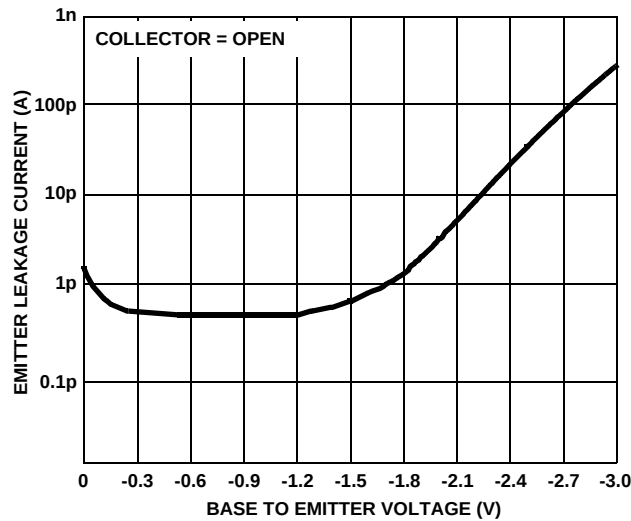


FIGURE 5. NPN EMITTER CUTOFF CURRENT vs BASE TO EMITTER VOLTAGE

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