Data Sheet February 1998 File Number 4445

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 (^oC)	PACKAGE	PKG. NO.
HFA3134IH96 (H04)	-40 to 85	6 Ld SOT23	P6.064
HFA3135IH96 (H05)	-40 to 85	6 Ld SOT23	P6.064

Features

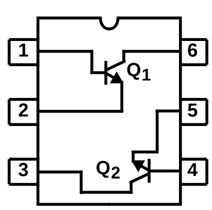
- NPN Transistor (f_T) 8.5GHz
- NPN Current Gain (h_{FE}) 100
- NPN Noise Figure (50Ω) at 1.0GHz 2.6dB
- PNP Transistor (f_T) 7GHz
- PNP Current Gain (h_{FE}) 57
- PNP Noise Figure (50Ω) at 900MHz 4.6dB
- Small Package (EIAJ-SC74 Compliant) SOT23-6

Applications

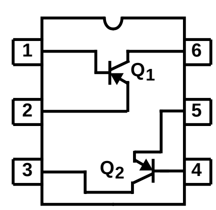
- VHF/UHF Amplifiers
- VHF/UHF Mixers
- IF Converters
- Synchronous Detectors

Pinouts

HFA3134
(SOT23)
TOP VIEW



HFA3135
(SOT23)
TOP VIEW



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°C
26mA at T_J =125°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) θ_{JA} (°C/W)
SOT23-6 Package 350
Maximum Junction Temperature (Die) .175°C
Maximum Junction Temperature (Plastic Package) . . . . .150°C
Maximum Storage Temperature Range . . . . -65°C to 150°C
Maximum Lead Temperature . . . . .300°C
(Soldering 10s, Lead Tips Only)

Operating Conditions

Temperature Range . . . . -40°C to 85°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:

1. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.
2. 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°C

PARAMETER	SYMBOL	TEST CONDITIONS	TEST LEVEL (NOTE 3)	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS FOR HFA3134 (NPN)							
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10µA, I_E = 0	A	12	21	-	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 100µA, I_B = 0	A	4	9	-	V
	$V_{(BR)CER}$	I_C = 100µA, R_B = 10kΩ	A	11	17	-	V
Emitter-to-Base Breakdown Voltage (Note 4)	$V_{(BR)EBO}$	I_E = 10µA, I_C = 0	B	-	6	-	V
Collector-Cutoff-Current	I_{CEO}	V_{CE} = 6V, I_B = 0	A	-5	-	5	nA
Collector-Cutoff-Current	I_{CBO}	V_{CB} = 8V, I_E = 0	A	-5	-	5	nA
Emitter-Cutoff-Current (Note 5)	I_{EBO}	V_{EB} = 1V, I_C = 0	B	-	1	-	pA
Collector-to-Collector Leakage			C	-	1	-	nA
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_C = 10mA, I_B = 1mA	A	-	95	250	mV
Base-to-Emitter Voltage (Note 5)	V_{BE}	I_C = 10mA, V_{CE} = 2V	A	-	780	1000	mV
Q_1 to Q_2 Base-to-Emitter Voltage Match (Note 5)	ΔV_{BE}	I_C = 10mA, V_{CE} = 2V	A	-	1.2	6	mV
		I_C = 1mA, V_{CE} = 2V	A	-	1.0	6	mV
		I_C = 0.1mA, V_{CE} = 2V	A	-	0.7	6	mV
Base-to-Emitter Voltage Drift		I_C = 10mA	C	-	-1.5	-	mV/°C
DC Forward-Current Transfer Ratio (Note 5)	h_{FE}	I_C = 10mA, V_{CE} = 2V	A	48	80	200	
		I_C = 1mA, V_{CE} = 2V	A	48	87	200	
		I_C = 0.1mA, V_{CE} = 2V	A	48	90	200	
		I_C = 10mA, V_{CE} = 5V	A	48	96	200	
		I_C = 1mA, V_{CE} = 5V	A	48	96	200	
		I_C = 0.1mA, V_{CE} = 5V	A	48	100	200	
Q_1 to Q_2 Current Transfer Ratio Match	Δh_{FE}	1mA ≤ I_C ≤ 10mA, 1V ≤ V_{CE} ≤ 5V	A	-	2	8	%
Early Voltage	V_A	I_C = 1mA, ΔV_{CE} = 3V	A	20	30	-	V

Electrical Specifications $T_A = 25^oC$

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

Electrical Specifications $T_A = 25^oC$

PARAMETER	SYMBOL	TEST CONDITIONS	TEST LEVEL (NOTE 3)	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS FOR HFA3135 (PNP)							
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = -10μA, I_E = 0	A	12	21	-	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = -100μA, I_B = 0	A	4	14	-	V
	$V_{(BR)CER}$	I_C = -100μA, R_B = 10kΩ	A	11	23	-	V
Emitter-to-Base Breakdown Voltage (Note 4)	$V_{(BR)EBO}$	I_E = -10μA, I_C = 0	B	-	5	-	V
Collector-Cutoff-Current	I_{CEO}	V_{CE} = -6V, I_B = 0	A	-5	-	5	nA
Collector-Cutoff-Current	I_{CBO}	V_{CB} = -8V, I_E = 0	A	-5	-	5	nA
Emitter-Cutoff-Current	I_{EBO}	V_{EB} = -1V, I_C = 0	B	-	TBD	-	pA
Collector-to-Collector Leakage			B	-	1	-	nA
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_C = -10mA, I_B = -1mA	A	-	150	250	mV
Base-to-Emitter Voltage	V_{BE}	I_C = -10mA, V_{CE} = -2V	A	-	850	1000	mV
Q_1 to Q_2 Base-to-Emitter Voltage Match	ΔV_{BE}	I_C = -10mA, V_{CE} = -2V	A	-	1	6	mV
		I_C = -1mA, V_{CE} = -2V	A	-	1	6	mV
		I_C = -0.1mA, V_{CE} = -2V	A	-	2	6	mV
DC Forward-Current Transfer Ratio	h_{FE}	I_C = -10mA, V_{CE} = -2V	A	15	40	125	
		I_C = -1mA, V_{CE} = -2V	A	15	47	125	
		I_C = -0.1mA, V_{CE} = -2V	A	15	52	125	
		I_C = -10mA, V_{CE} = -5V	A	15	47	125	
		I_C = -1mA, V_{CE} = -5V	A	15	53	125	
		I_C = -0.1mA, V_{CE} = -5V	A	15	57	125	
Q_1 to Q_2 Current Gain Match	Δh_{FE}	-1mA ≤ I_C ≤ -10mA, -1V ≤ V_{CE} ≤ -5V	A	-	1	8	%
Early Voltage	V_A	I_C = -1mA, ΔV_{CE} = -3V	A	15	24	-	V
Base-to-Emitter Voltage Drift		I_C = -10mA	C	-	-1.4	-	mV/^oC

Electrical Specifications $T_A = 25^oC$

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

NOTES:

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

Typical Performance Curves $T_A = 25^oC$, Unless Otherwise Specified

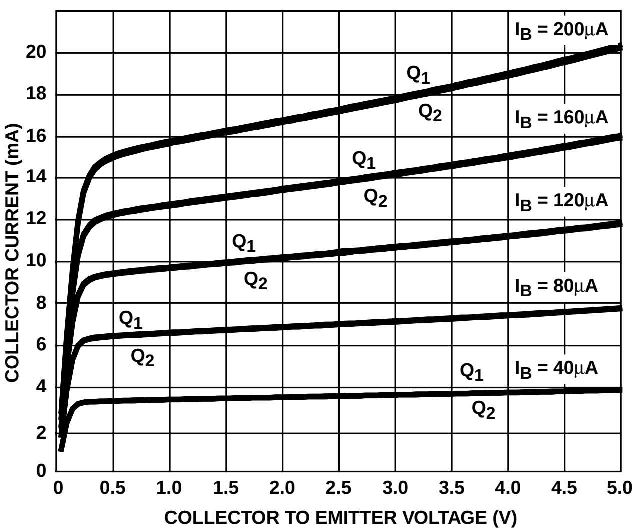


FIGURE 1. NPN COLLECTOR CURRENT vs COLLECTOR TO EMITTER VOLTAGE

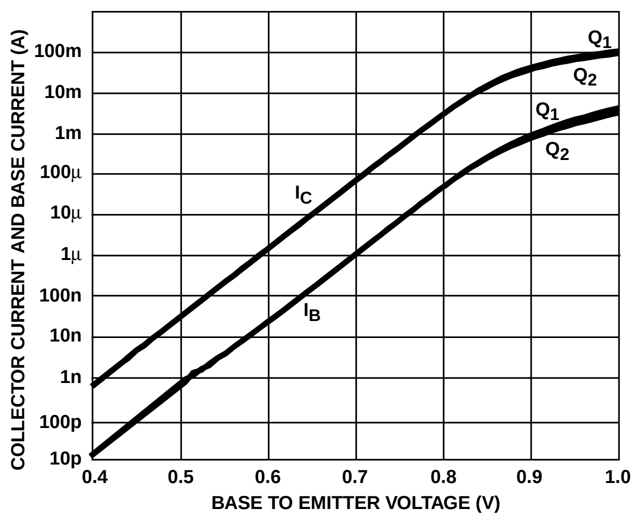


FIGURE 2. NPN COLLECTOR AND BASE CURRENTS vs BASE TO EMITTER VOLTAGE

Typical Performance Curves $T_A = 25^oC$, Unless Otherwise Specified **(Continued)**

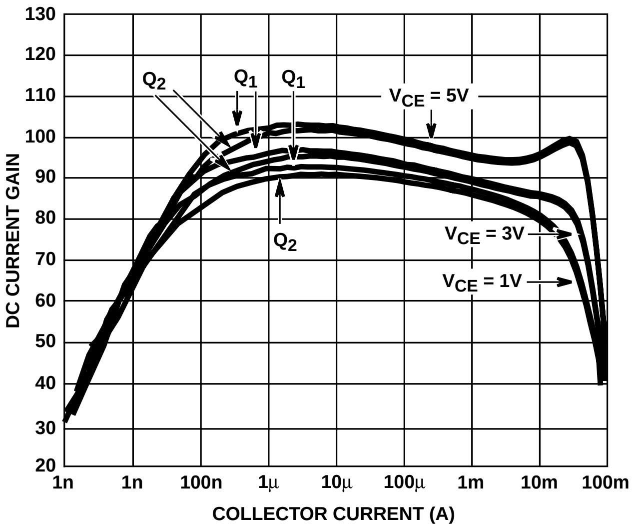


FIGURE 3. NPN DC CURRENT GAIN vs COLLECTOR CURRENT

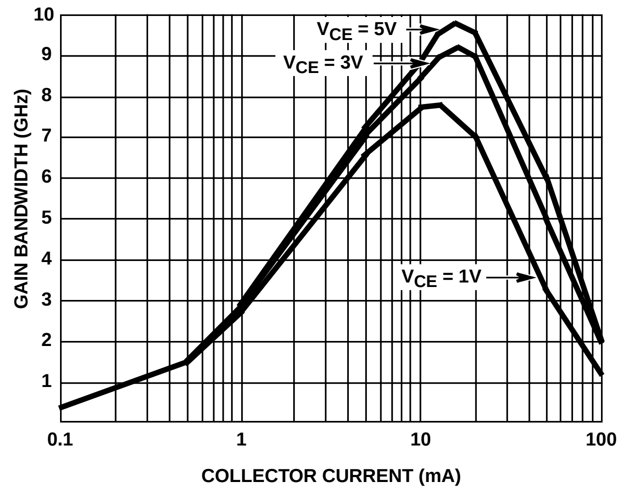


FIGURE 4. NPN GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT

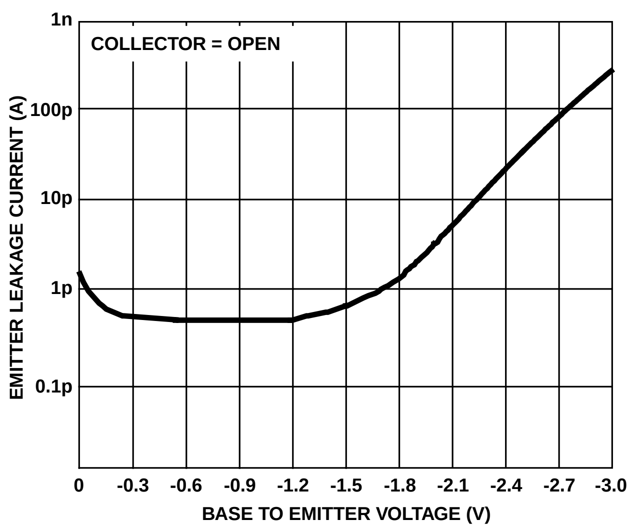


FIGURE 5. NPN EMITTER CUTTOFF CURRENT vs BASE TO EMITTER VOLTAGE

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