RENESAS

DATASHEET

HFA3134, HFA3135

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. DWG. #
HFA3134IH96 (04/†0)	-40 to 85	6 Ld SOT23 Tape and Reel	P6.064
HFA3134IHZ96 (4Z/ Z†) (Note)	-40 to 85	6 Ld SOT23 Tape and Reel (Pb-free)	P6.064
HFA3135IH96 (05/90)	-40 to 85	6 Ld SOT23 Tape and Reel	P6.064
HFA3135IHZ96 (5Z/9Z) (Note)	-40 to 85	6 Ld SOT23 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.

FN4445 Rev 2.00 August 12, 2005

Features

•	NPN Transistor (f_T) $\dots \dots \dots$
•	NPN Current Gain (h _{FE})
•	NPN Noise Figure (50 Ω) at 1.0GHz 2.6dB
•	PNP Transistor (f_T)
•	PNP Current Gain (h _{FE})
•	PNP Noise Figure (50 Ω) 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





HFA3135 (SOT23) TOP VIEW





Absolute Maximum Ratings

Collector to Emitter Voltage ($R_B \le 10k\Omega$ to GND)
Collector to Base Voltage (Open Emitter)
Emitter to Base Voltage (Reverse Bias)
Collector Current
26mA at T _J = 125°C
Base Current (Note 2)
ESD Rating
Human Body Model
(Per MIL-STD-883 Method 3015.7)

Operating Conditions

Temperature Range-40°C to 85°C

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	5°C to 150°C
Maximum Lead Temperature	300°C
(Soldering 10s, Lead Tips Only)	

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.

NOTES:

- 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	(NOTE 3) TEST LEVEL	MIN	ТҮР	МАХ	UNITS
DC CHARACTERISTICS FOR HFA3134 (NPN)		1					
Collector to Base Breakdown Voltage	V _{(BR)CBO}	$I_{C} = 10\mu A, I_{E} = 0$	А	12	21	-	V
Collector to Emitter Breakdown Voltage	V _{(BR)CEO}	I _C = 100μA, I _B = 0	А	4	9	-	V
	V _{(BR)CER}	I _C = 100μA, R _B = 10kΩ	А	11	17	-	V
Emitter to Base Breakdown Voltage (Note 4)	V _{(BR)EBO}	$I_{E} = 10 \mu A, I_{C} = 0$	В	-	6	-	V
Collector-Cutoff-Current	ICEO	V _{CE} = 6V, I _B = 0	А	-5	-	5	nA
Collector-Cutoff-Current	I _{CBO}	V _{CB} = 8V, I _E = 0	А	-5	-	5	nA
Emitter-Cutoff-Current (Note 5)	I _{EBO}	V _{EB} = 1V, I _C = 0	В	-	1	-	pА
Collector to Collector Leakage			С	-	1	-	nA
Collector to Emitter Saturation Voltage	V _{CE(SAT)}	I _C = 10mA, I _B = 1mA	А	-	95	250	mV
Base to Emitter Voltage (Note 5)	V _{BE}	I _C = 10mA, V _{CE} = 2V	А	-	780	1000	mV
Q_1 to Q_2 Base to Emitter Voltage Match	ΔV _{BE}	I _C = 10mA, V _{CE} = 2V	А	-	1.2	6	mV
(Note 5)		I _C = 1mA, V _{CE} = 2V	А	-	1.0	6	mV
		I _C = 0.1mA, V _{CE} = 2V	А	-	0.7	6	mV
Base to Emitter Voltage Drift		I _C = 10mA	С	-	-1.5	-	mV/°C
DC Forward-Current Transfer Ratio	h _{FE}	I _C = 10mA, V _{CE} = 2V	А	48	80	200	
(Note 5)		I _C = 1mA, V _{CE} = 2V	А	48	87	200	
		I _C = 0.1mA, V _{CE} = 2V	А	48	90	200	
		I _C = 10mA, V _{CE} = 5V	А	48	96	200	
		I _C = 1mA, V _{CE} = 5V	А	48	96	200	
		I _C = 0.1mA, V _{CE} = 5V	А	48	100	200	
Q_1 to Q_2 Current Transfer Ratio Match	∆h _{FE}	$\begin{array}{l} 1mA \leq I_C \leq 10mA, \\ 1V \leq V_{CE} \leq 5V \end{array}$	A	-	2	8	%
Early Voltage	V _A	$I_C = 1mA$, $\Delta V_{CE} = 3V$	А	20	30	-	V



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

PARAMETER	SYMBOL	TEST CONDITIONS	(NOTE 3) TEST LEVEL	MIN	ТҮР	MAX	UNITS	
DYNAMIC CHARACTERISTICS FOR HFA3134 (NPN)								
Noise Figure	NF	$\label{eq:f} \begin{array}{l} f = 1.0GHz, \ I_C = 10mA, \\ 1V \leq V_{CE} \leq 5V, \ Z_S = 50\Omega \end{array}$	В	-	2.4	-	dB	
		$\label{eq:states} \begin{array}{l} f = 1.0GHz, \ I_C = 1mA, \\ 1V \leq V_{CE} \leq 5V, \ Z_S = 50\Omega \end{array}$	В	-	2.6	-	dB	
Current Gain-Bandwidth Product	f _T	I _C = 10mA, V _{CE} = 5V	В	-	8.5	-	GHz	
(Note 5)		I _C = 1mA, V _{CE} = 5V	В	-	3	-	GHz	
Power Gain-Bandwidth Product	f _{MAX}	I _C = 10mA, V _{CE} = 5V	В	-	7.5	-	GHz	
Base to Emitter Capacitance		V _{BE} = -0.5V	В	-	600	-	fF	
Collector to Base Capacitance		V _{CB} = 3V	В	-	500	-	fF	

Electrical Specifications T_A = 25°C

PARAMETER	SYMBOL	TEST CONDITIONS	(NOTE 3) TEST LEVEL	MIN	ТҮР	MAX	UNITS
DC CHARACTERISTICS FOR HFA3135 (PNP)							
Collector to Base Breakdown Voltage	V _{(BR)CBO}	I _C = -10μA, I _E = 0	А	12	21	-	V
Collector to Emitter Breakdown Voltage	V _{(BR)CEO}	I _C = -100μA, I _B = 0	А	4	14	-	V
	V _{(BR)CER}	I_{C} = -100μA, R _B = 10kΩ	А	11	23	-	V
Emitter to Base Breakdown Voltage (Note 4)	V _{(BR)EBO}	I _E = -10μA, I _C = 0	В	-	5	-	V
Collector-Cutoff-Current	ICEO	V _{CE} = -6V, I _B = 0	А	-5	-	5	nA
Collector-Cutoff-Current	I _{CBO}	V _{CB} = -8V, I _E = 0	А	-5	-	5	nA
Emitter-Cutoff-Current	I _{EBO}	V _{EB} = -1V, I _C = 0	В	-	TBD	-	pА
Collector to Collector Leakage			В	-	1	-	nA
Collector to Emitter Saturation Voltage	V _{CE(SAT)}	I _C = -10mA, I _B = -1mA	А	-	150	250	mV
Base to Emitter Voltage	V _{BE}	I _C = -10mA, V _{CE} = -2V	А	-	850	1000	mV
Q_1 to Q_2 Base to Emitter Voltage Match	ΔV_{BE}	I _C = -10mA, V _{CE} = -2V	А	-	1	6	mV
		I _C = -1mA, V _{CE} = -2V	А	-	1	6	mV
		I _C = -0.1mA, V _{CE} = -2V	А	-	2	6	mV
DC Forward-Current Transfer Ratio	h _{FE}	I _C = -10mA, V _{CE} = -2V	А	15	40	125	
		I _C = -1mA, V _{CE} = -2V	А	15	47	125	
		I _C = -0.1mA, V _{CE} = -2V	А	15	52	125	
		I _C = -10mA, V _{CE} = -5V	А	15	47	125	
		I _C = -1mA, V _{CE} = -5V	А	15	53	125	
		I _C = -0.1mA, V _{CE} = -5V	А	15	57	125	
Q_1 to Q_2 Current Gain Match	∆h _{FE}	-1mA \leq I _C \leq -10mA, -1V \leq V _{CE} \leq -5V	A	-	1	8	%
Early Voltage	VA	I_C = -1mA, ΔV_{CE} = -3V	А	15	24	-	V
Base to Emitter Voltage Drift		I _C = -10mA	С	-	-1.4	-	mV/°C



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

PARAMETER	SYMBOL	TEST CONDITIONS	(NOTE 3) TEST LEVEL	MIN	ТҮР	МАХ	UNITS	
DYNAMIC CHARACTERISTICS FOR HFA3135 (PNP)								
Noise Figure	NF	$\label{eq:states} \begin{array}{l} f = 900MHz, \ I_C = -10mA, \\ -1V \leq V_{CE} \leq -5V, \ Z_S = 50\Omega \end{array}$	В	-	5.2	-	dB	
		$\label{eq:states} \begin{array}{l} f = 900MHz, \ I_C = -1mA, \\ -1V \leq V_{CE} \leq -5V, \ Z_S = 50\Omega \end{array}$	В	-	4.6	-	dB	
Current Gain-Bandwidth Product	f _T	I _C = -10mA, V _{CE} = -5V	В	-	7	-	GHz	
Power Gain-Bandwidth Product	f _{MAX}	I _C = -10mA, V _{CE} = -5V	В	-	TBD	-	GHz	
Base to Emitter Capacitance		V _{BE} = 0.5V	В	-	550	-	fF	
Collector to Base Capacitance		V _{CB} = -3V	В	-	400	-	fF	

NOTES:

3. Test Level: A. Production Tested; B. Typical or Guaranteed Limit Based on Characterization; C. Design Typical for Information Only.

4. Measuring $V_{\mbox{EBO}}$ can degrade the transistor $h_{\mbox{FE}}$ and $h_{\mbox{FE}}$ match.

5. See Typical Performance Curves for more information.

Typical Performance Curves T_A = 25°C, Unless Otherwise Specified







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



Typical Performance Curves T_A = 25°C, Unless Otherwise Specified (Continued)



FIGURE 3. NPN DC CURRENT GAIN vs COLLECTOR CURRENT









© Copyright Intersil Americas LLC 2000-2005. All Rights Reserved. All trademarks and registered trademarks are the property of their respective owners.

For additional products, see www.intersil.com/en/products.html

Intersil products are manufactured, assembled and tested utilizing ISO9001 quality systems as noted in the quality certifications found at <u>www.intersil.com/en/support/qualandreliability.html</u>

Intersil products are sold by description only. Intersil may modify the circuit design and/or specifications of products at any time without notice, provided that such modification does not, in Intersil's sole judgment, affect the form, fit or function of the product. Accordingly, the reader is cautioned to verify that datasheets 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 www.intersil.com

FN4445 Rev 2.00 August 12, 2005

