SiGe High Dynamic Range Low Noise Transistor

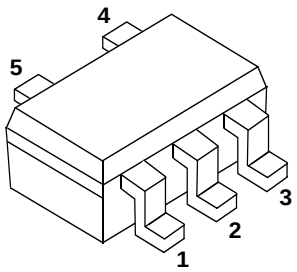
Features

- Low Noise Figure: NFmin ≈ 1.1dB @ 2.0GHz V_{CE} = 2.0V, I_C=5mA
- Low Operating Voltage V_{CE} = 1.0 to 2.5V
- Input IIP3 Capability: ≈ + 10dBm @ 2.0GHz, V_{CE} = 2.5V, I_C=10mA
- Package: SOT353

Description

The IBM43RF0100 is a Silicon-Germanium (SiGe) NPN transistor designed for high performance, low cost applications. Utilizing IBM's SiGe process and packaging technologies, high gain, low noise and exceptional linearity at low power consumption are possible. Assembled in a miniature surface mount package, this product is designed for applications requiring high performance such as LNAs, VCOs, and other low noise transistor applications.

Pin Diagram



Pin Assignments

Pin 1	Base
Pin 2	Ground[1]
Pin 3	Emitter
Pin 4	Collector
Pin 5	Emitter

1. Connection requires a low resistance path to signal ground.

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Ordering Information

Part Number	Description
IBM43RF0100	Supplied in Tape and Reel packaging
IBM43RF0100EV19	1900MHz evaluation board for IBM43RF0100
IBM43RF0100EV09	900MHz evaluation board for IBM43RF0100

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit	Notes
V_{CBO}	Collector to Base Voltage	7	V	1
V_{CEO}	Collector to Emitter Voltage	4.5	V	1
V_{EBO}	Emitter to Base Voltage	2.0	V	1
I_C	Collector Current	75	mA	1
T_J	Operating Junction Temperature	140	°C	1
T_{STG}	Storage Temperature	-65 to +150	°C	1

1. Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

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DC Electrical Characteristics (T_A = +25°C)

Symbol	Parameter	Min.	Typ.	Max.	Units	Notes
β	Beta	45	100	165		1
V_A	Early Voltage	30	65		V	
V_{BE}	Base Emitter Voltage I_{CC}=10µA	755	770	785	mV	
BV_{CEO}	Collector Emitter Breakdown Voltage Base open.	3	3.3		V	2
BV_{CES}	Collector Emitter Breakdown Voltage Base shorted.	7	10.5		V	
BV_{EBO}	Emitter Base Breakdown Voltage	3.2	4.0		V	2
BV_{CBO}	Collector Base Breakdown Voltage	7	10.5		V	2
BV_{SO}	Collector Substrate Breakdown Voltage	30	45.0		V	2

1. V_{CE}=2.5V, I_C= 5mA
2. I_R=10µA

AC Characteristics (V_{CE} = 2.0V,I_{CC} = 5mA, T_A = +25°C)

Symbol	Parameter		Min.	Typ.	Max.	Units
$\|S_{21}\|^2$	Small Signal Insertion Power Gain	900 MHz	16.0	17.5		dB
		1900 MHz	11.0	12.5		
NF	Noise Figure	900 MHz		0.9	1.7	
		1900 MHz		1.1	2.3	

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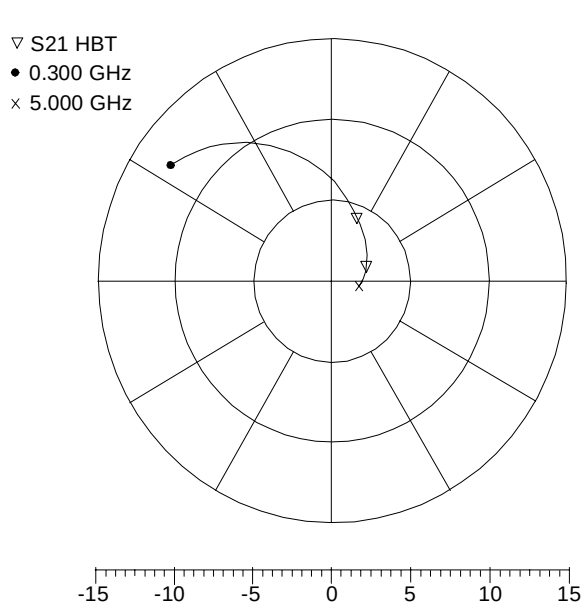
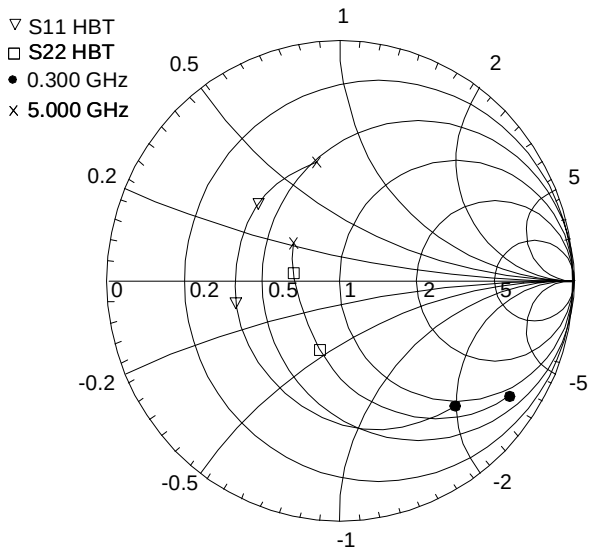
Typical Scattering Parameters (T_A=25°C, V_{CE}=2.0V, I_{CQ}=5.0mA)

Frequency (GHz)	S11		S21		S12		S22	
	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
0.100	0.805	-19.1	14.445	164.2	0.025	77.3	1.008	-15.2
0.200	0.765	-32.8	13.558	155.0	0.036	70.8	0.943	-24.2
0.300	0.725	-46.5	12.671	145.8	0.047	64.3	0.878	-33.2
0.400	0.685	-60.2	11.784	136.6	0.058	57.8	0.813	-42.2
0.500	0.650	-72.7	10.919	128.3	0.067	52.4	0.747	-50.0
1.000	0.522	-119.2	7.309	98.9	0.093	36.8	0.503	-77.4
1.500	0.472	-150.1	5.294	79.5	0.109	30.0	0.368	-95.2
2.000	0.457	-173.3	4.108	64.1	0.123	25.4	0.287	-109.7
2.500	0.461	167.7	3.369	50.5	0.139	21.2	0.233	-125.3
3.000	0.465	151.4	2.842	37.7	0.156	16.0	0.204	-141.0
3.500	0.477	137.4	2.451	25.7	0.176	10.9	0.169	-164.0
4.000	0.488	124.5	2.164	14.3	0.190	3.8	0.198	179.7
4.500	0.499	112.6	1.929	3.0	0.209	-2.8	0.215	157.8
5.000	0.507	101.2	1.740	-8.1	0.229	-9.3	0.259	141.3

Polar Plot of S21 and Smith Chart of S11 & S22 (T_A=25°C, V_{CE}=2.0V, I_{CQ}=5.0mA)





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Typical Noise Parameters (T_A=25°C, V_{CE}=2.0V, I_{CQ}=5.0mA)

Frequency (GHz)	NFmin (dB)	Gamma (mag)	Gamma (ang)	R_N (normalized to 50 ohms)	NF 50 Ohms (dB)	Associated Gain (dB)
0.5	0.8	0.35	32	0.18	0.9	25.5
0.8	0.9	0.34	43	0.16	1.0	21
1.0	0.9	0.32	50	0.16	1.0	19
1.8	1.1	0.30	93	0.12	1.2	14
2.0	1.1	0.28	101	0.12	1.2	13
2.5	1.3	0.23	127	0.11	1.4	11
3.0	1.4	0.28	157	0.09	1.5	10
4.0	1.6	0.32	-160	0.09	1.7	8

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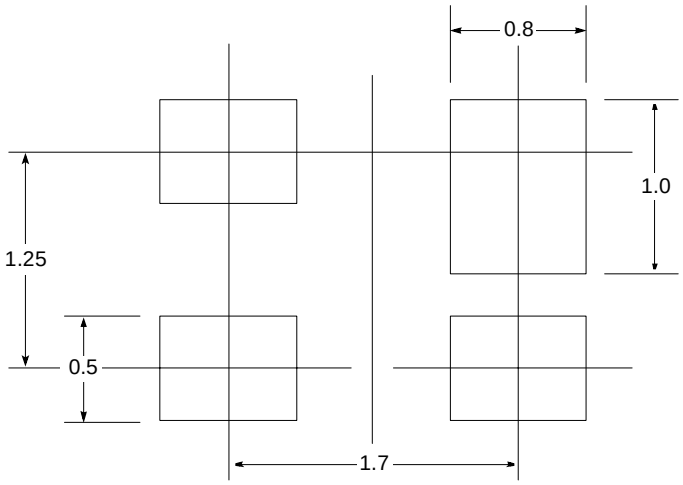
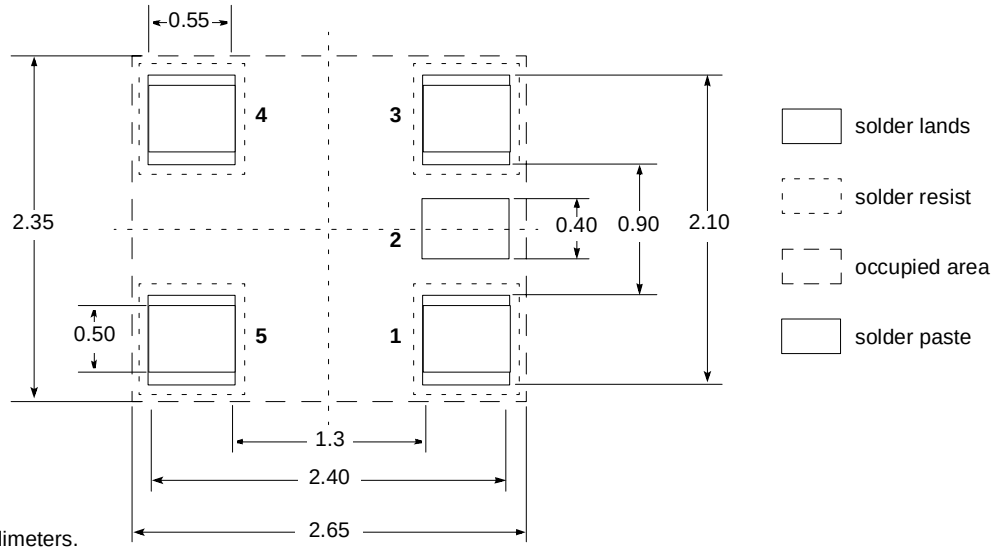
Recommended PCB Layout



All dimensions are millimeters.

Recommended Reflow Soldering Footprint - All Leads Separated



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Revision Log

Rev	Contents of Modification
7/98	Initial release.
8/98	First revision. Refined layout without changing content.
9/98	Second revision. Added Recommended Reflow Soldering Footprint.
11/98	Third revision. Revised scattering and noise parameter data.
04/99	Fourth revision (04). Changed part number IBMSGRF0100 to IBM43RF0100. Distinguished between two evaluation boards in Ordering Information table. Revised low noise figure in Features list.
05/03/99	Fifth revision (05). Corrected V_{CC} value in Features list. Distinguished between 900MHz and 1900MHz frequencies for two parameters in AC Characteristics on page 3. Added Associated Gain column to Typical Noise Parameters on page 5. Added Composition of leads note to Package Diagram: SOT 353 on page 10.
04/27/00	Updated Beta max limit and junction temperature rating. Removed application PCB information.

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