

Microwave Low Noise **SiGe HBT** KT1151

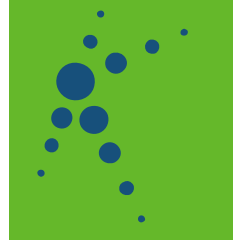


Spring 2012

KT1151

Microwave Low Noise

SiGe Heterojunction Bipolar Transistor



Features

- Operation Voltage: 10 V
- Operating Temperature: -55°C to $+85^{\circ}\text{C}$
- Low Noise figure and High Gain
 $N_F=1.0\text{dB}$ (Typ), $G_a=12\text{dB}$ (Typ)
@ $V_{CE}=10\text{V}$, $I_C=7\text{mA}$, $f=1\text{GHz}$
- High Power Gain
 $G_{\max}=14\text{dB}$ (Typ) @ $V_{CE}=10\text{V}$, $I_C=20\text{mA}$, $f=1\text{GHz}$
- Cost Effective 3-lead SOT23, 3-lead SOT323, 4-lead SOT143 package types

Applications

- RF front end
- Communication and instrument system
- Satellite receiver
- Television antenna
- Walkie-talkie and cordless telephone
- Remote controller and security apparatus

Product Description

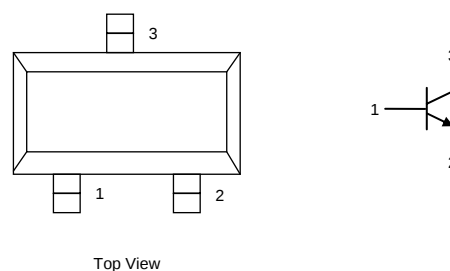
The KT1151 is a SiGe NPN HBT (Heterojunction bipolar transistor) designed for low noise high gain amplifier at CATV, UHF and VHF band. It has advantages such as low noise figure, high power gain, high voltage, broad dynamic range and good linearity. It can be applied in low noise high gain amplifier. The KT1551 is available in cost effective 3-lead SOT23, 3-lead SOT323, and 4-lead SOT143 package type.

Pin Configuration

➤ Table 1: Pin descriptions of SOT23/SOT323

Pin Name	Description
1	Base
2	Emitter
3	Collector

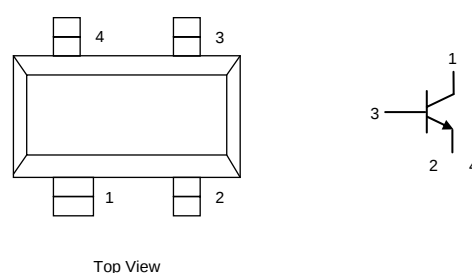
3-lead SOT23/SOT323



➤ Table 2: Pin descriptions of SOT143

Pin Name	Description
1	Collector
2	Emitter
3	Base
4	Emitter

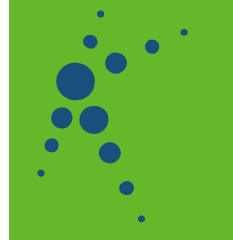
4-lead SOT143



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Electrical Specifications

Absolute Maximum Ratings

Symbol	Parameter	Max. Value	Unit
V_{CBO}	Collector to Base Voltage	20	V
V_{CEO}	Collector to Emitter Voltage	12	V
V_{EBO}	Emitter to Base Voltage	1	V
I_{CM}	Collector Current (DC)	100	mA
P_{tot}	Total Power Dissipation	200	mW
T_j	Junction Temperature	150	°C
T_{stg}	Storage Temperature	-65 to +150	°C

Comments:

Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is stress rating only and functional operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended period may affect reliability.

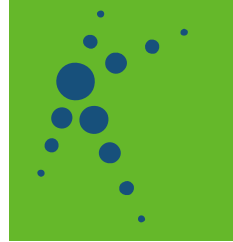
Electrical Characteristic

Symbol	Parameter	Conditions ($T_{amb}=25^{\circ}C$)	Min.	Typ.	Max.	Unit
I_{CBO}	Collector-Base Leakage Current	$V_{CB}=10V, I_E=0A$	—	—	1	μA
I_{EBO}	Emitter-Base Leakage Current	$V_{EB}=0.5V, I_C=0A$	—	—	1	μA
h_{FE}	DC Current Gain	$V_{CE}=10V, I_C=20mA$	125	160	300	—
f_T	Transition Frequency	$V_{CE}=10V, I_C=20mA, f=1GHz$	—	7	—	GHz
$ S_{21} ^2$	Insertion Power Gain	$V_{CE}=10V, I_C=20mA, f=1GHz$	—	12	—	dB
N_F	Noise Figure	$V_{CE}=10V, I_C=7mA, f=1GHz,$ $\Gamma_S = \Gamma_{opt}$	—	1.0	1.2	dB

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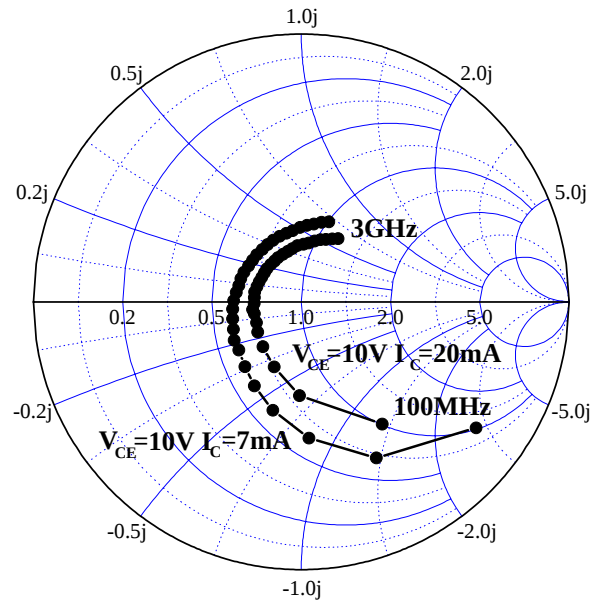
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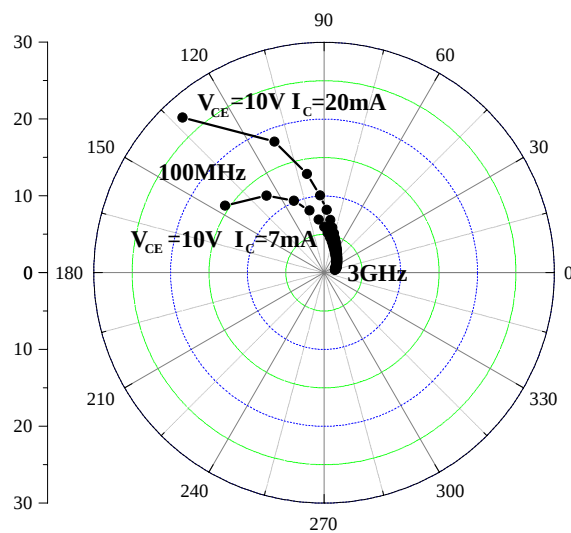


Typical Characteristics

➤ Figure 1: Common emitter input reflection coefficient (S_{11})



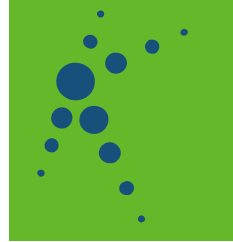
➤ Figure 2: Common emitter forward transmission coefficient (S_{21})



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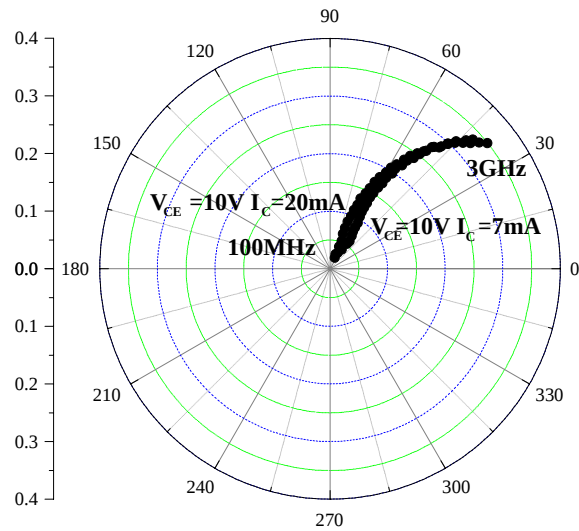
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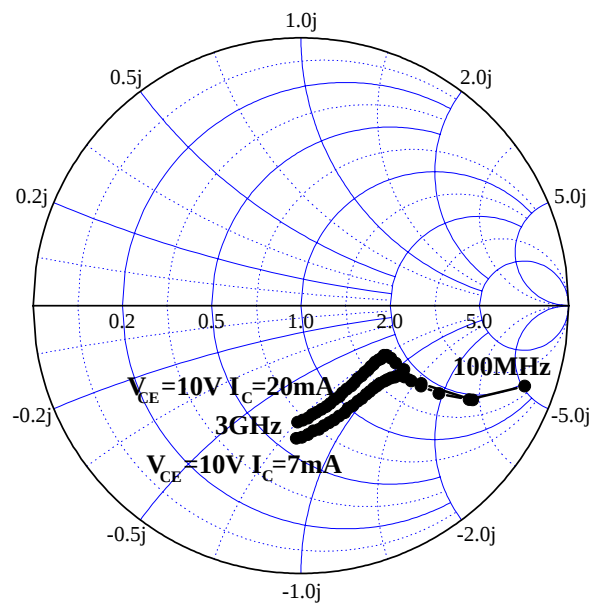


Typical Characteristics

➤ Figure 3: Common emitter reverse transmission coefficient (S_{12})



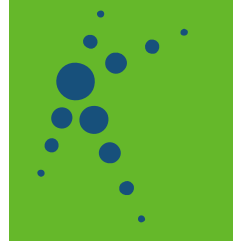
➤ Figure 4: Common emitter output reflection coefficient (S_{22})



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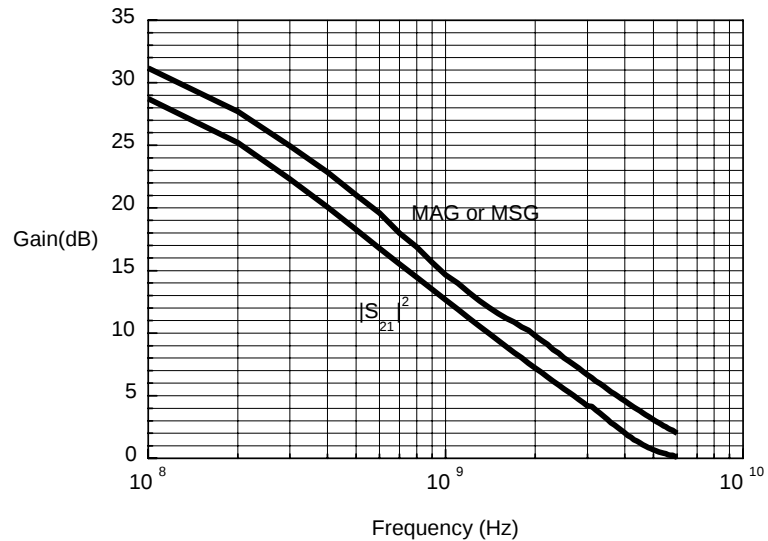
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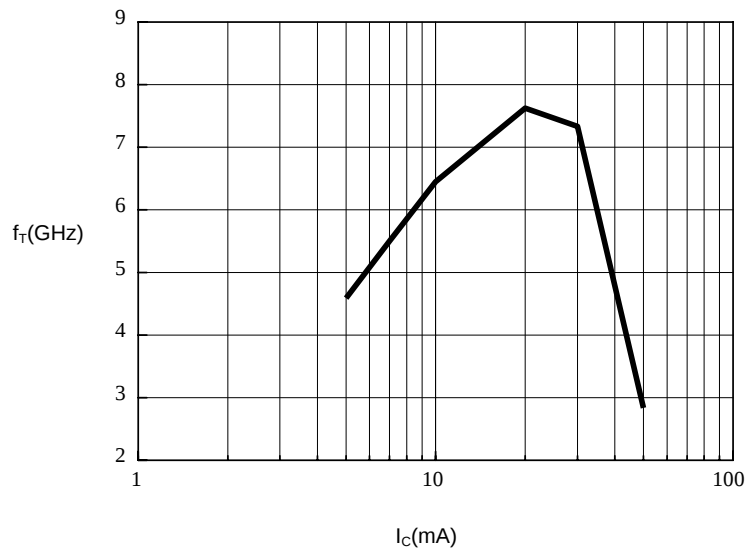


Typical Characteristics

- Figure 5: Maximum available gain (MAG) or maximum stable gain (MSG) and insertion gain $|S_{21}|^2$ as a function of frequency: $V_{CE}=10V$, $I_C=20mA$



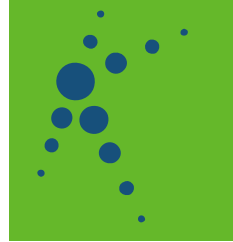
- Figure 6: Transition frequency f_T as a function of collector current I_C : $V_{CE}=10V$, $f=1GHz$



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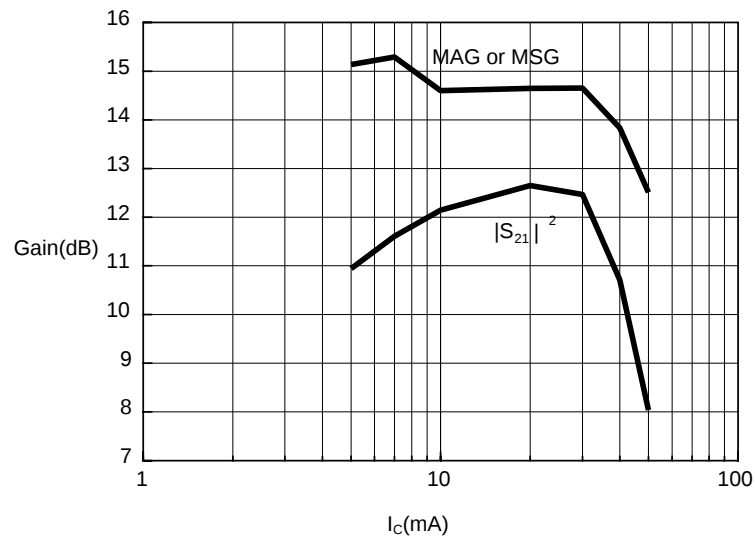
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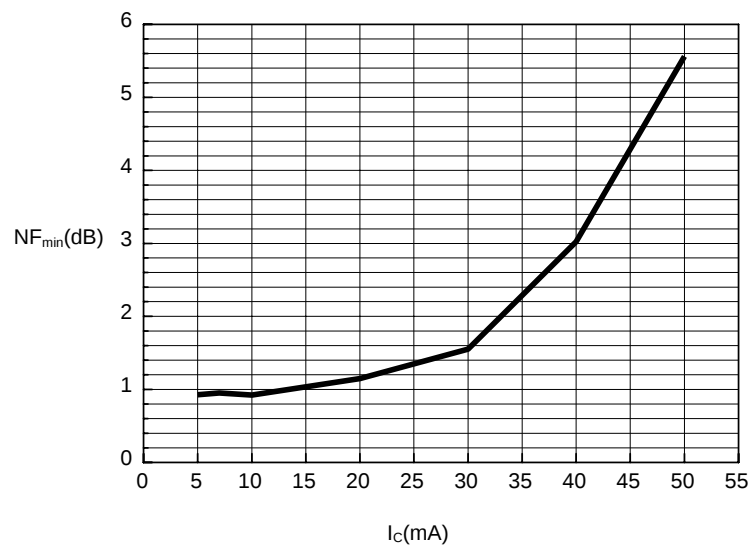


Typical Characteristics

► Figure 7: Maximum available gain (MAG) or maximum stable gain (MSG) and insertion gain $|S_{21}|^2$ as a function of collector current I_C : $V_{CE}=10V$, $f=1GHz$



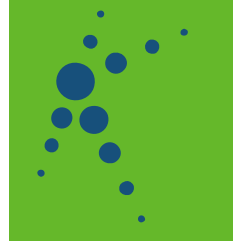
► Figure8: Minimum noise figure NF_{min} as a function of collector current I_C : $V_{CE}=10V$, $f=1GHz$, $\Gamma_S = \Gamma_{opt}$



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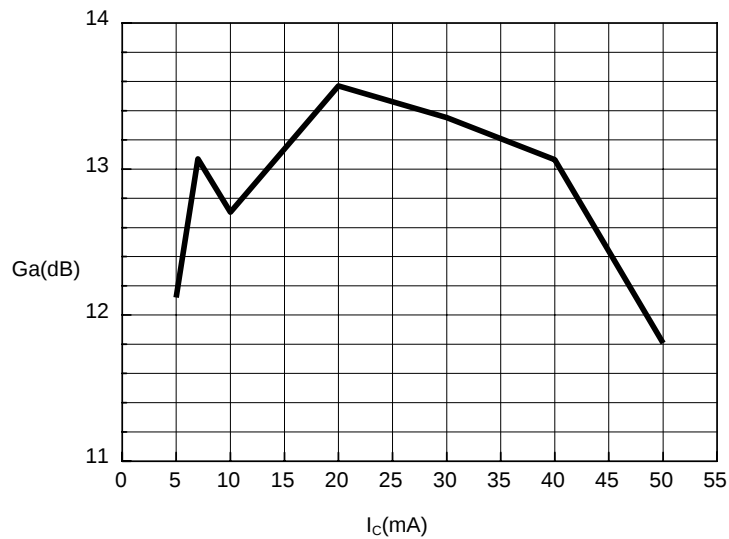
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Typical Characteristics

➤ Figure 9: Associate gain G_a as a function of collector current I_C : $V_{CE}=10V$, $f=1GHz$, $\Gamma_S = \Gamma_{opt}$



Reference Data

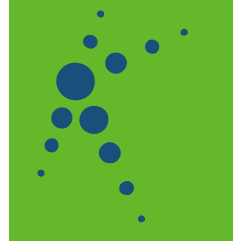
➤ Table 1: Noise parameters

$V_{CE}(V)$	Frequency(GHz)	$I_C(mA)$	$NF_{min}(dB)$	r_n	$ G_{opt} $	Phase(G_{opt})(deg)	$G_a(dB)$
10	1	5	0.9267	0.083	0.366	122.73	12.12
		7	0.951	0.029	0.432	145.07	13.069
		10	0.925	0.101	0.171	127.51	12.704
		20	1.1492	0.11	0.16	-168.06	13.569
		30	1.5529	0.157	0.164	-143.25	13.352
		40	3.0242	0.281	0.583	-137.76	13.064
		50	5.56	0.551	0.769	-142.43	11.808

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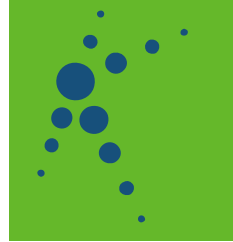
► Table 2: S parameters as a function of frequency: $V_{CE}=10V$, $I_C=7Ma$

Frequency(GHz)	$S_{11}(dB)$	$S_{11}(deg)$	$S_{21}(dB)$	$S_{21}(deg)$	$S_{12}(dB)$	$S_{12}(deg)$	$S_{22}(dB)$	$S_{22}(deg)$
0.1	-1.890327	-35.75266	23.84054	145.8975	-31.42062	69.68338	-1.032766	-19.73839
0.2	-3.790029	-64.34622	21.96526	126.76	-28.18675	59.37149	-2.853342	-29.17259
0.3	-5.858675	-86.72697	20.1351	112.8558	-25.61975	55.91588	-4.288249	-32.46138
0.4	-7.572659	-104.6936	18.40191	103.0879	-24.63733	54.63145	-5.35956	-33.7837
0.5	-8.884513	-119.1244	16.86366	95.7132	-23.33167	56.82598	-6.032059	-34.29755
0.6	-9.893926	-130.9901	15.49801	89.80818	-22.43588	58.27502	-6.579365	-34.47518
0.7	-10.62103	-142.4007	14.34242	84.72718	-21.56354	58.91526	-6.955575	-35.39914
0.8	-10.79405	-150.138	13.36271	80.38406	-20.64843	59.01424	-7.118883	-37.21396
0.9	-11.2804	-158.0176	12.42685	76.32546	-19.65806	60.19518	-7.30596	-38.69178
1.0	-11.58443	-166.2215	11.60593	72.44841	-18.96743	61.01495	-7.443597	-40.55039
1.1	-11.76834	-174.043	10.8727	68.80353	-18.29947	61.02324	-7.534631	-42.14634
1.2	-11.95079	178.85458	10.18312	65.14976	-17.6648	60.75163	-7.661667	-44.36913
1.3	-12.1991	171.62245	9.570965	61.76519	-16.9465	60.84861	-7.69009	-46.41804
1.4	-12.34187	165.36287	8.986975	58.72304	-16.3946	60.28791	-7.729839	-48.63736
1.5	-12.31799	158.88707	8.473034	55.50126	-15.7339	59.50306	-7.719945	-51.28456
1.6	-12.35496	152.54747	7.98377	52.54887	-15.18689	58.51901	-7.711567	-53.60774
1.7	-12.44609	145.59431	7.519518	49.33485	-14.64671	58.34565	-7.646688	-56.67441
1.8	-12.41394	139.36996	7.088491	46.4897	-14.10282	56.9252	-7.628314	-59.24486
1.9	-12.31119	133.34146	6.696947	43.64117	-13.68364	56.87745	-7.522218	-62.54232
2.0	-12.25791	126.65965	6.293682	40.70271	-13.19425	55.20388	-7.49745	-65.3502
2.1	-12.09804	120.477	5.953167	37.7455	-12.73754	54.62778	-7.298613	-67.78866
2.2	-11.9215	114.44061	5.601864	35.09089	-12.3623	52.95804	-7.218492	-70.97312
2.3	-11.76361	108.30038	5.272975	32.42318	-11.95123	52.01157	-7.050978	-73.87585
2.4	-11.61758	102.21156	4.939789	29.51518	-11.55374	50.76113	-6.955257	-76.48169
2.5	-11.43395	97.000481	4.629924	27.1339	-11.12062	49.56667	-6.814826	-79.301
2.6	-11.10883	90.905075	4.339925	24.44936	-10.84879	47.73477	-6.62359	-81.72484
2.7	-10.86457	85.830688	4.057012	22.22043	-10.50034	46.73811	-6.560863	-84.44099
2.8	-10.62233	80.772697	3.781769	19.66584	-10.14174	45.34833	-6.346648	-86.96667
2.9	-10.26852	75.725319	3.517863	17.06487	-9.766047	43.39563	-6.176757	-89.63596
3.0	-9.992444	71.021553	3.238778	14.89561	-9.523214	42.202	-6.096388	-91.96452

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Reference Data

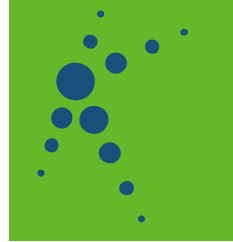
► Table 3: S parameters as a function of frequency: $V_{CE}=10V$, $I_C=20mA$

Frequency(GHz)	$S_{11}(dB)$	$S_{11}(deg)$	$S_{21}(dB)$	$S_{21}(deg)$	$S_{12}(dB)$	$S_{12}(deg)$	$S_{22}(dB)$	$S_{22}(deg)$
0.1	-5.236367	-56.44019	28.74002	132.4126	-33.60398	67.71787	-2.708029	-28.72095
0.2	-9.121131	-91.08381	25.21785	110.7521	-30.20223	64.59299	-5.421799	-32.92452
0.3	-11.58653	-112.602	22.30977	99.91914	-27.57398	67.84179	-6.893324	-31.80406
0.4	-13.14188	-130.6271	20.07032	93.0033	-25.6381	67.44988	-7.678114	-31.21599
0.5	-14.07761	-145.1442	18.27457	87.72212	-23.77471	70.10577	-8.202931	-30.33082
0.6	-14.66465	-155.1144	16.776	83.42197	-22.41633	69.97046	-8.634908	-30.12361
0.7	-14.87979	-165.9172	15.51886	79.67584	-21.16135	69.62764	-8.849785	-30.9218
0.8	-14.71994	-171.1152	14.46192	76.21609	-20.13963	68.38862	-8.914659	-33.49255
0.9	-15.1005	-178.2229	13.48753	72.82852	-19.14227	67.90921	-9.027106	-34.7443
1.0	-15.09494	174.59673	12.64962	69.62594	-18.35764	66.8158	-9.16621	-37.15203
1.1	-14.99958	167.74078	11.8906	66.56718	-17.52447	66.61116	-9.159519	-39.1269
1.2	-15.13245	160.73003	11.18555	63.44478	-16.77371	64.74655	-9.22771	-41.04105
1.3	-15.185	154.24644	10.54859	60.58032	-16.13126	63.86601	-9.198278	-43.71259
1.4	-15.21041	147.91365	9.970599	57.77449	-15.42283	62.76552	-9.265064	-46.13872
1.5	-15.11214	141.76501	9.415549	54.93739	-14.83991	61.50206	-9.208406	-49.24095
1.6	-14.9616	135.94598	8.93394	52.23166	-14.28171	59.88632	-9.239331	-51.99205
1.7	-14.87695	129.25687	8.442511	49.34644	-13.76397	59.00277	-9.095153	-55.20491
1.8	-14.78889	123.0338	8.027659	46.76259	-13.34975	57.47196	-9.022107	-57.81182
1.9	-14.57638	117.93794	7.59926	44.21963	-12.82136	55.84966	-8.97245	-61.2308
2.0	-14.36912	111.24313	7.213419	41.58925	-12.3759	54.61741	-8.867113	-64.51269
2.1	-14.19405	105.13256	6.871173	38.76862	-12.00202	52.90886	-8.677807	-67.06526
2.2	-13.91137	99.432854	6.492268	36.3242	-11.6751	51.51049	-8.585791	-70.33294
2.3	-13.5077	93.985443	6.169189	33.79795	-11.20311	50.02445	-8.384017	-73.42574
2.4	-13.32878	87.826813	5.852214	31.09388	-10.95991	48.05563	-8.220256	-75.90258
2.5	-13.07395	82.853455	5.540524	28.85225	-10.51513	46.64745	-8.063693	-78.77274
2.6	-12.64218	77.635765	5.257439	26.34418	-10.23276	45.23106	-7.904775	-81.83842
2.7	-12.27915	72.888237	4.990792	24.11102	-9.957667	43.48913	-7.768597	-84.13326
2.8	-12.00109	68.446541	4.72054	21.84814	-9.711356	41.8254	-7.526423	-86.53788
2.9	-11.64305	63.812271	4.462542	19.30947	-9.39463	40.23702	-7.383921	-89.11553
3.0	-11.2759	59.748352	4.173822	17.22131	-9.128655	38.66048	-7.231069	-91.60966

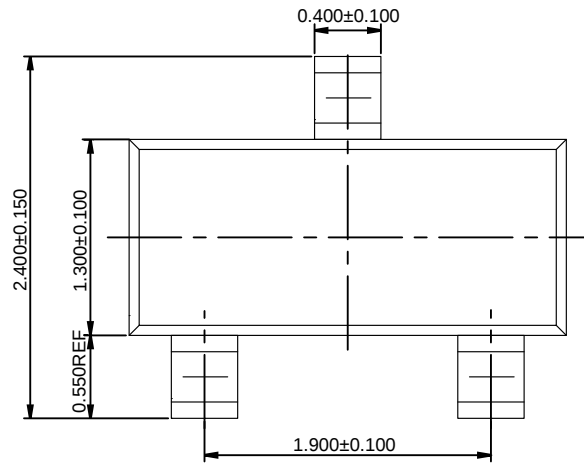
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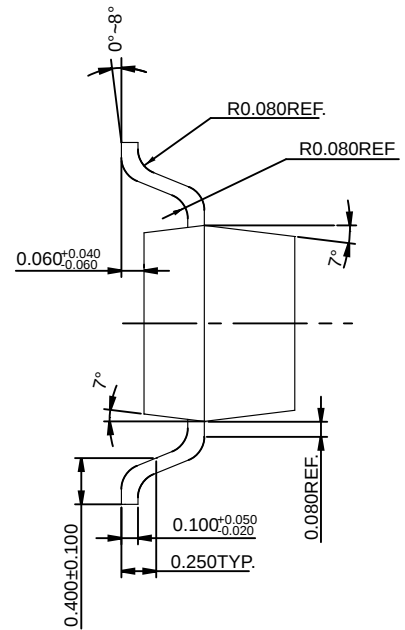
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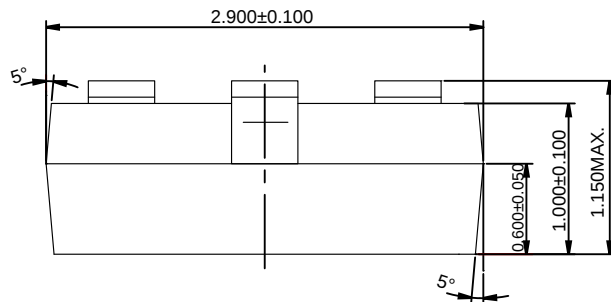
3-lead SOT23 package diagram



Top View



End View

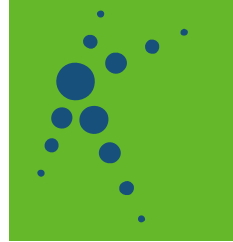


Side View

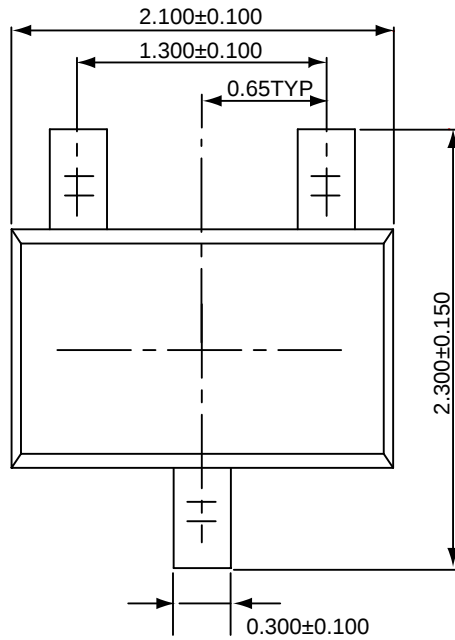
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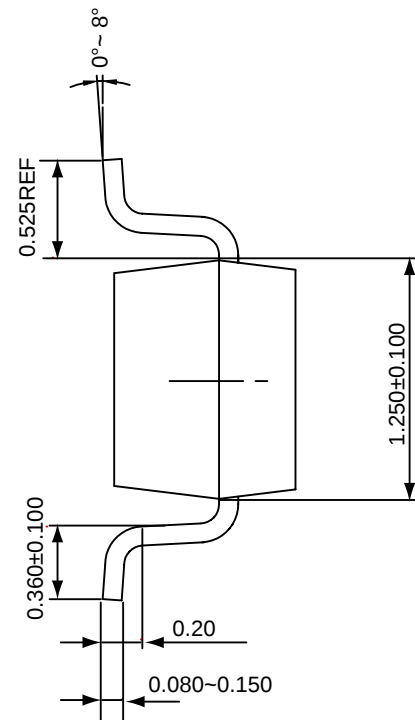
SiGe Heterojunction Bipolar Transistor



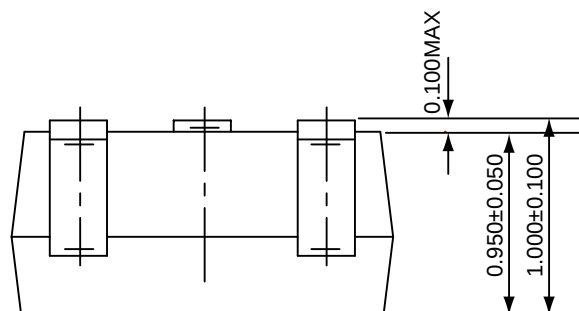
3-lead SOT323 package diagram



Top View



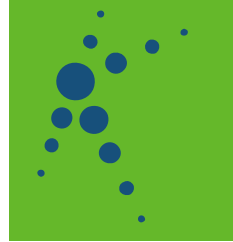
End View



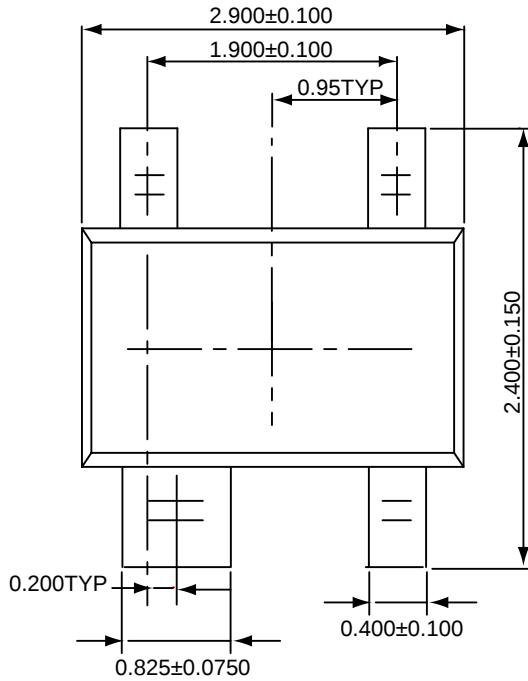
Side View

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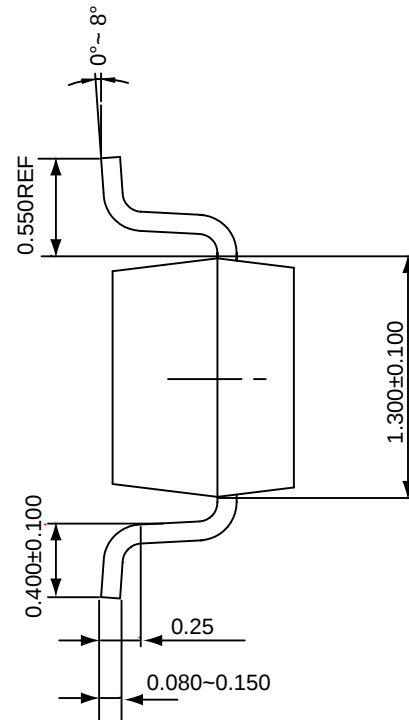
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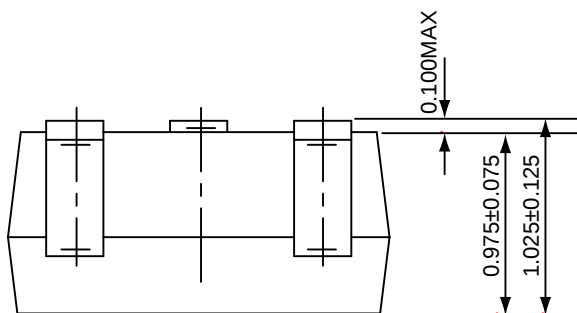
■ 4-lead SOT143 package diagram



Top View



End View

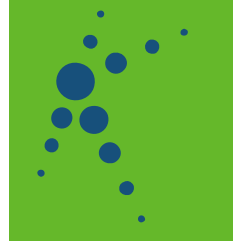


Side View

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Ordering Information

Code Number													
Part Number			K	T	1	1	5	X	-	XX	X	X	X
			1	2	3					4	5	6	7

1. Prefix	4. Package Type	5. Temperature Range	7. Plating Technology
2. Series Name	OA = SOT23	I = Industry (-55°C to 85°C)	G = RoHS compliant
SiGe HBT	OC = SOT143	6. Pack Type	X = Green
3. Design Version	OD = SOT323	B = Bulk (ESD bag)	
		A = Ammopack	
		R = Reel (Tape)	

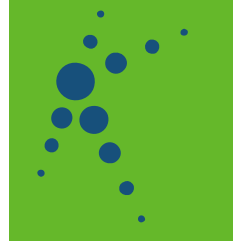
Product Datasheet Change Notice

Datasheet Revision History		
Version	Content	Date
1.0	Initial version	Jan., 2011
1.1	SOT323, SOT143 package information added. h _{FE} specification modified	Mar., 2011
1.2	Update the figure 1 to 9 & the table 1 to 3.	Mar.,2012

KT1151

Microwave Low Noise

SiGe Heterojunction Bipolar Transistor



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Data Sheet, Revision 1.2

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