

# 18.0-38.0 GHz GaAs MMIC Buffer Amplifier

April 2005 - Rev 01-Apr-05

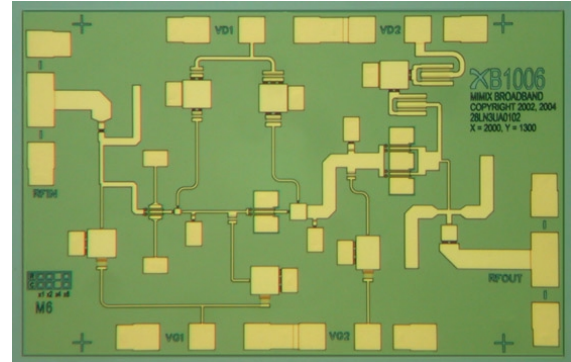
## Features

- ✕ High Dynamic Range/Positive Gain Slope
- ✕ Excellent LO Driver/Buffer Amplifier
- ✕ Low Noise or Power Bias Configurations
- ✕ 21.0 dB Small Signal Gain
- ✕ 3.2 dB Noise Figure at Low Noise Bias
- ✕ +15 dBm P1dB Compression Point at Power Bias
- ✕ 100% On-Wafer RF, DC and Noise Figure Testing
- ✕ 100% Visual Inspection to MIL-STD-883 Method 2010

## General Description

Mimix Broadband's three stage 18.0-38.0 GHz GaAs MMIC buffer amplifier has a small signal gain of 21.0 dB with a positive gain slope, and a noise figure of 3.2 dB across the band. This MMIC uses Mimix Broadband's 0.15  $\mu\text{m}$  GaAs PHEMT device model technology, and is based upon electron beam lithography to ensure high repeatability and uniformity. The chip has surface passivation to protect and provide a rugged part with backside via holes and gold metallization to allow either a conductive epoxy or eutectic solder die attach process. This device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

## Chip Device Layout



## Absolute Maximum Ratings

Supply Voltage (Vd)	+6.0 VDC
Supply Current (Id)	120 mA
Gate Bias Voltage (Vg)	+0.3 VDC
Input Power (Pin)	+5 dBm
Storage Temperature (Tstg)	-65 to +165 °C
Operating Temperature (Ta)	-55 to MTTF Table <sup>5</sup>
Channel Temperature (Tch)	MTTF Table <sup>5</sup>

(5) Channel temperature affects a device's MTBF. It is recommended to keep channel temperature as low as possible for maximum life.

## Electrical Characteristics (Ambient Temperature T = 25 °C)

Parameter	Units	Min.	Typ.	Max.
Frequency Range (f)	GHz	18.0	-	38.0
Input Return Loss (S11) <sup>3</sup>	dB	4.0	14.0	-
Output Return Loss (S22) <sup>3</sup>	dB	7.0	12.0	-
Small Signal Gain (S21) <sup>3</sup>	dB	19.0	21.0	27.0
Gain Flatness ( $\Delta S21$ )	dB	-	+/-2.0	-
Reverse Isolation (S12) <sup>3</sup>	dB	40.0	50.0	-
Noise Figure (NF) <sup>4</sup>	dB	-	3.2	4.5
Output Power for 1 dB Compression (P1dB) <sup>1,2,3</sup>	dBm	-	+15.0	-
Output Third Order Intercept Point (OIP3) <sup>1,2,3</sup>	dBm	-	+25.0	-
Saturated Output Power (Psat) <sup>1,2,3</sup>	dBm	+14.0	+18.0	-
Drain Bias Voltage (Vd1,2)	VDC	-	+3.5	+5.5
Gate Bias Voltage (Vg1,2)	VDC	-1.2	-0.3	+0.1
Supply Current (Id) (Vd=3.5V, Vg=-0.3V Typical)	mA	-	50	100

(1) Optional low noise bias Vd1,2=3.5V, Id=50mA will typically yield 3-4dB decreased P1dB and OIP3.

(2) Measured using constant current.

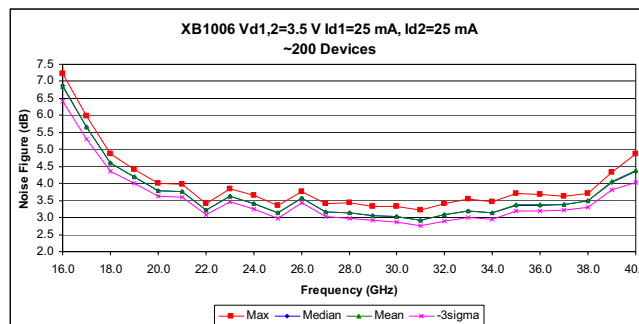
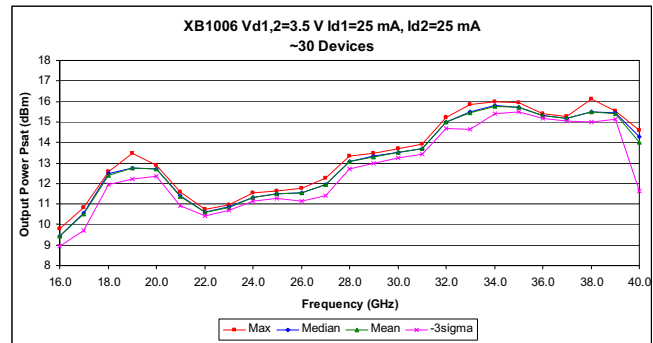
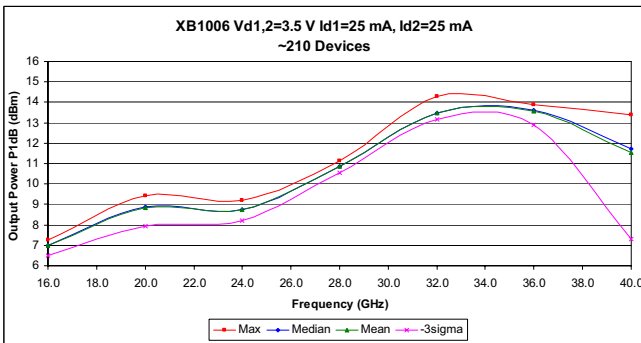
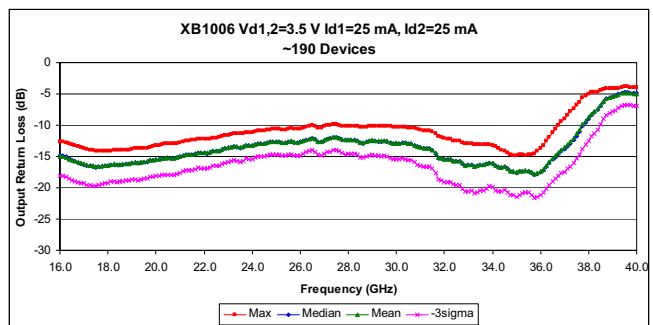
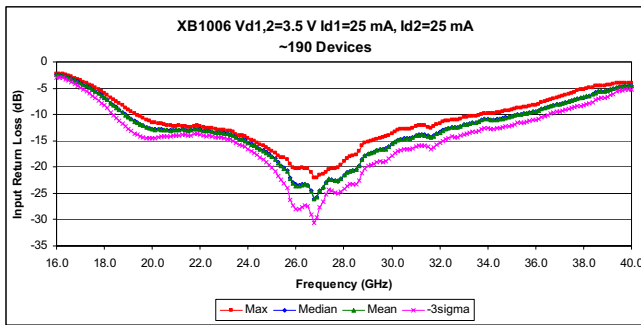
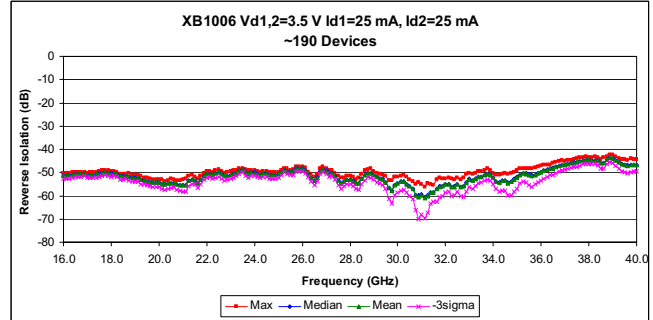
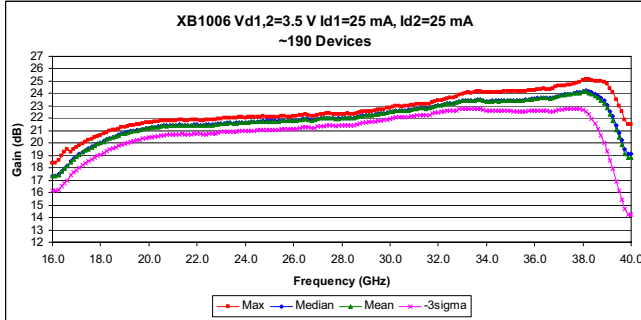
(3) Unless otherwise indicated, min/max over 18.0-38.0 GHz and biased at Vd=5.5V, Id1=50mA, Id2=50mA.

(4) Unless otherwise indicated, min/max over 20.0-38.0 GHz and biased at Vd=3.5V, Id1=25mA, Id2=25mA.

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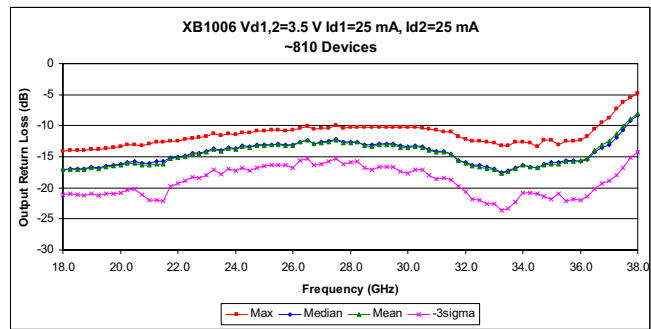
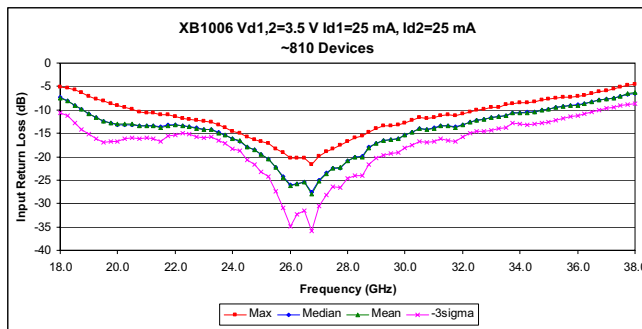
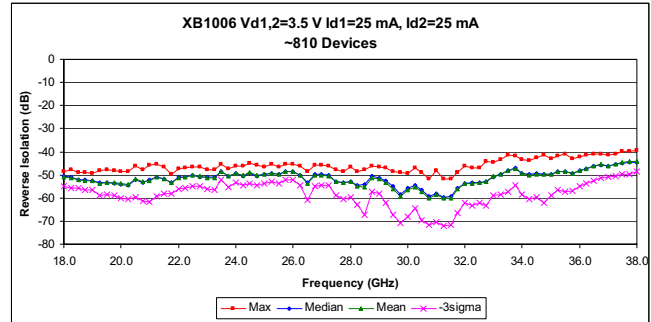
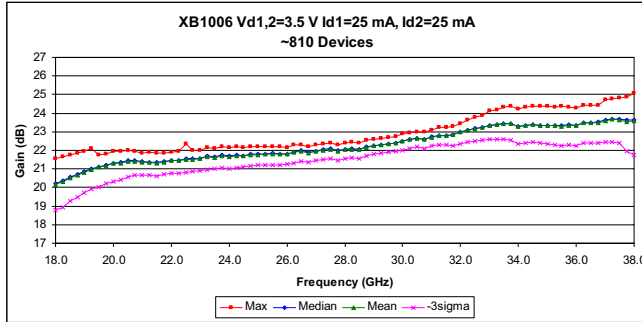
## Buffer Amplifier Measurements



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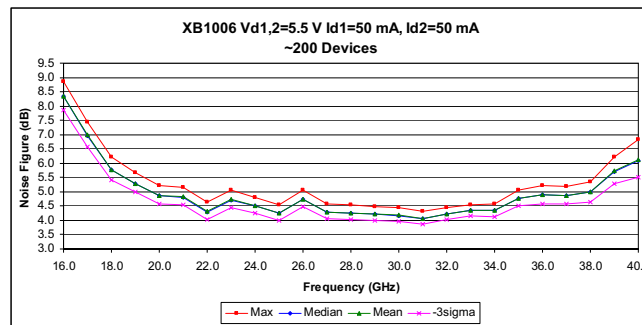
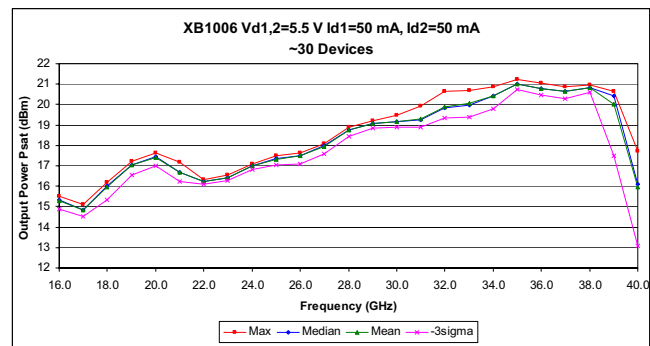
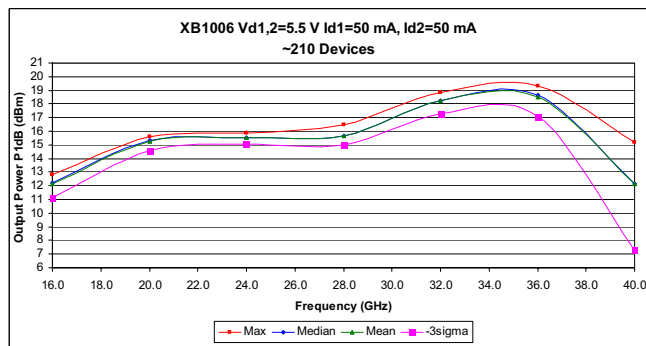
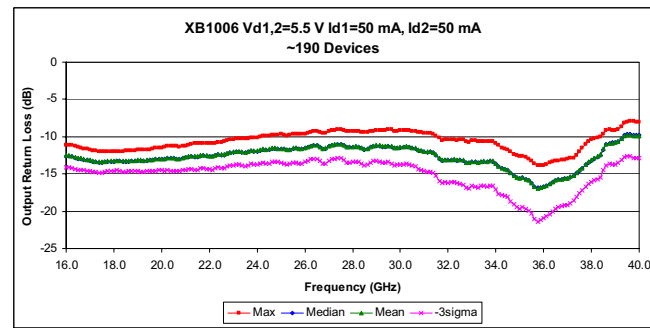
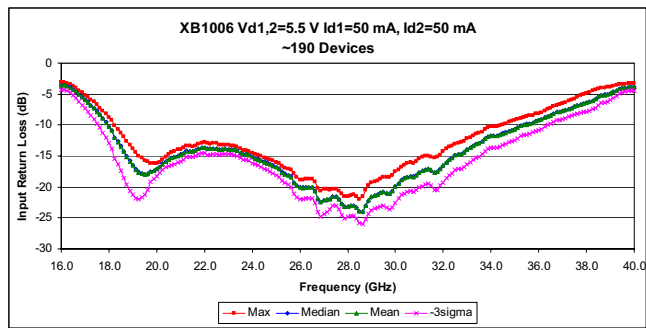
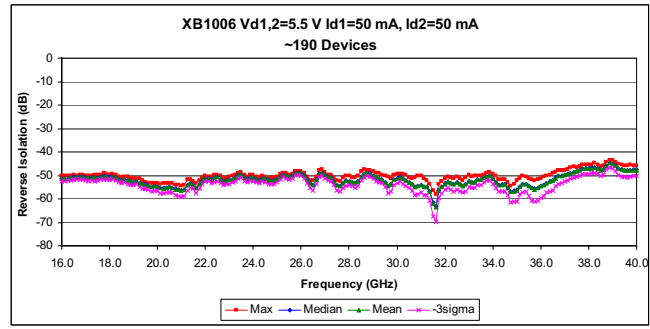
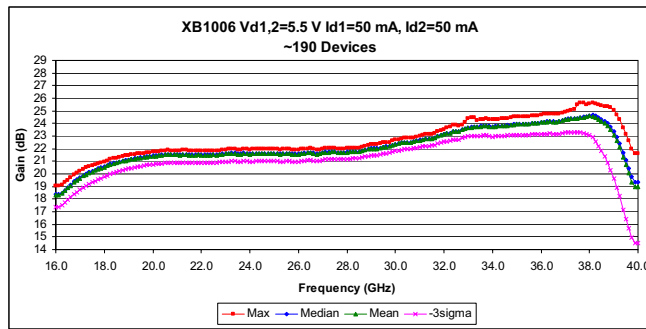
## Buffer Amplifier Measurements (cont.)



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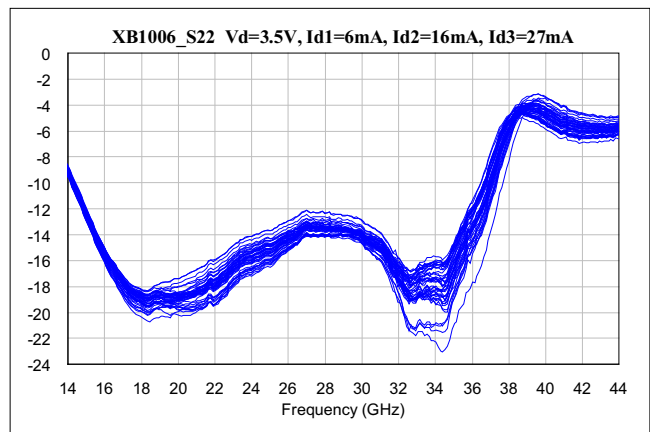
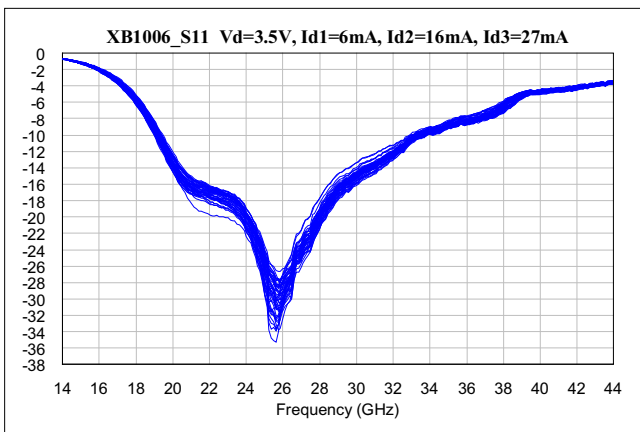
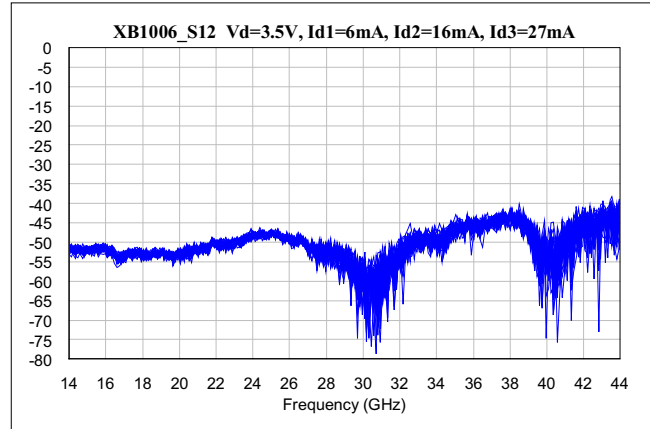
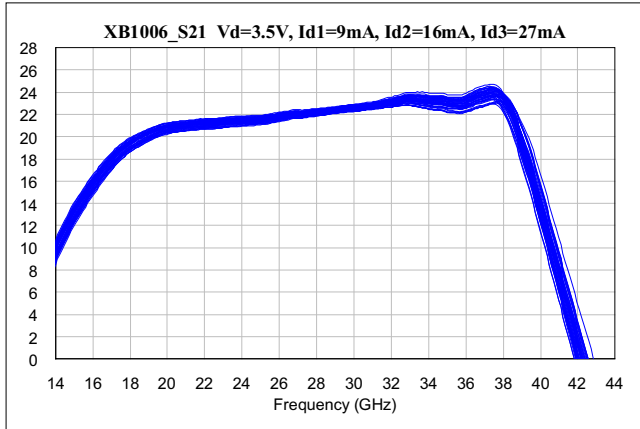
## Buffer Amplifier Measurements (cont.)



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## Buffer Amplifier Measurements (cont.)



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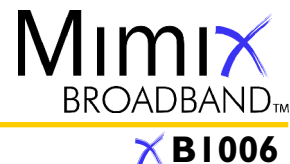
## S-Parameters

Typical S-Parameter Data for XB1006

Vd=3.5 V Id1=25 mA Id2=25 mA

Frequency (GHz)	S11 Mag dB	S11 Phase Ang°	S12 Mag dB	S12 Phase Ang°	S21 Mag dB	S21 Phase Ang°	S22 Mag dB	S22 Phase Ang°
18.00	-7.773806601	110.93875	-51.10986812	139.10685	20.22639513	84.969925	-17.32815226	-38.716015
18.25	-8.162747323	105.98645	-51.49522883	135.14065	20.34244897	80.260965	-17.23889907	-71.98476
18.50	-9.130519159	94.211605	-52.17691825	135.1086	20.52858812	70.446355	-17.21312958	-130.19765
18.75	-10.02790389	81.788275	-52.50009774	135.01865	20.67675717	60.82064	-17.26944122	135.5954
19.00	-10.95498978	67.86153	-52.72913708	134.78135	20.8248181	51.66703	-16.98382628	64.634375
19.25	-11.74494329	53.389425	-53.91884964	133.50715	20.97514946	42.279825	-17.1440838	-10.82046
19.50	-12.46646314	38.568515	-53.18329373	137.41785	21.09349368	33.177575	-16.88958232	-86.80098
19.75	-12.79467832	22.71995	-52.95588896	140.61805	21.15698194	24.465385	-16.79694374	-138.0544
20.00	-13.14270248	6.292512	-53.38806637	136.797	21.287821	15.5962	-16.57764791	121.56325
20.25	-13.12488683	-7.856535	-53.8705525	150.18175	21.32208872	6.8977315	-16.22096954	48.1719
20.50	-13.14723996	-23.77885	-50.95656409	147.3615	21.40545139	-1.950743	-16.15785598	-32.446515
20.75	-13.44876239	-35.24832	-52.29715539	140.4727	21.39281681	-10.7653	-16.53085465	-105.68465
21.00	-13.52084243	-46.837905	-51.39903551	138.7979	21.34517349	-19.08982	-16.64154193	147.5137
21.25	-13.5922257	-57.618795	-50.11938675	135.56395	21.30917776	-26.87138	-16.52182835	107.33095
21.50	-13.97287375	-63.98557	-51.13291392	112.8787	21.26862079	-34.241405	-16.59040735	39.155665
21.75	-13.51727823	-69.73093	-53.4636666	137.29845	21.34398378	-41.12318	-15.58802895	-34.84188
22.00	-13.4483806	-78.4264	-51.48477821	135.4175	21.41881496	-48.89947	-15.38597929	-112.24645
22.25	-13.5358511	-87.661645	-50.96277637	134.1523	21.43238058	-56.513925	-15.13983056	145.43045
22.50	-13.70280366	-94.262585	-50.45332234	133.70855	21.49123812	-63.89781	-14.683529	97.03156
22.75	-14.14391341	-100.45	-50.35491946	128.0535	21.49930107	-71.443245	-14.7185138	22.53718
23.00	-14.44812992	-104.23155	-51.39960177	122.7393	21.5230339	-78.35226	-14.44250801	-49.814175
23.25	-14.33906327	-110.20235	-51.59092697	135.94805	21.64441654	-85.662065	-13.86240665	-125.38725
23.50	-15.07247086	-121.0083	-48.34315964	121.337	21.61535654	-93.743035	-14.22712759	127.2124
23.75	-15.51049209	-121.9702	-50.72865172	124.4996	21.69825689	-100.36765	-13.7112322	85.07165
24.00	-16.43690686	-128.77055	-49.22340314	112.2295	21.66745741	-107.8524	-13.97537864	11.784975
24.25	-16.88508017	-133.52675	-50.02058269	114.94385	21.71732373	-114.79575	-13.52486386	-62.037595
24.50	-18.20792022	-139.1886	-48.60983333	104.94955	21.67390177	-121.93355	-13.71039736	-135.804
24.75	-18.83294463	-140.24175	-49.73830469	107.3189	21.75319709	-128.98265	-13.41819338	121.6335
25.00	-19.96208254	-141.17845	-49.30583589	102.85295	21.76547937	-136.1063	-13.32016951	77.39966
25.25	-20.82223024	-145.09375	-49.28286648	106.77275	21.78317594	-143.6224	-13.17482336	0.92489635
25.50	-22.79029586	-143.78405	-49.6824333	97.49384	21.79117948	-150.16325	-13.17239044	-70.638055
25.75	-24.94760788	-143.8243	-48.50064341	100.7873	21.79517237	-157.26305	-13.24128365	-127.79815
26.00	-27.10841867	-130.5347	-48.36792596	90.430805	21.78924749	-163.91555	-13.329818	134.06635
26.25	-26.38808597	-108.6829	-50.12736894	73.886185	21.88776471	-168.057	-12.76647816	71.10848
26.50	-25.99964975	-105.6947	-53.66485733	78.72533	21.96746477	-154.12085	-12.45015484	-3.951353
26.75	-28.62381019	-85.358905	-50.20618912	100.3937	21.85667908	168.80485	-13.05771689	-79.435885
27.00	-25.50145554	-72.0912	-50.23393698	80.41017	21.92911393	164.55675	-12.86769734	-130.0279
27.25	-23.80120592	-66.620625	-50.35674964	72.48015	22.00524641	161.4778	-12.71686385	134.75865
27.50	-22.42501743	-74.036545	-52.72589671	62.982355	22.04507077	154.0106	-12.41891179	62.149695
27.75	-22.20491724	-71.90979	-53.27339706	82.345675	21.94205768	147.25125	-12.94772593	-12.909965

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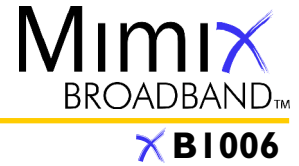
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## S-Parameters (cont.)

Typical S-Parameter Data for XB1006 (cont d)  
Vd=3.5 V Id1=25 mA Id2=25 mA

Frequency (GHz)	S11 Mag dB	S11 Phase Ang <sup>o</sup>	S12 Mag dB	S12 Phase Ang <sup>o</sup>	S21 Mag dB	S21 Phase Ang <sup>o</sup>	S22 Mag dB	S22 Phase Ang <sup>o</sup>
28.00	-20.66381518	-74.19205	-52.94661232	71.497485	22.03225657	141.07495	-12.87844679	-83.23196
28.25	-19.87292983	-77.176315	-54.74643355	66.575355	22.06353776	133.9532	-12.73997388	-134.3971
28.50	-19.85366645	-77.13162	-56.11457052	98.15153	22.0131024	127.3179	-13.33782149	125.6188
28.75	-17.92405155	-75.39207	-51.48487216	84.224615	22.15214193	121.28985	-13.50581312	59.033515
29.00	-17.05594411	-83.655265	-51.98067442	59.47228	22.24564578	114.034	-13.17055383	-12.35481
29.25	-16.48426215	-90.029385	-53.53555447	54.34412	22.29955836	106.9239	-13.12667704	-86.047915
29.50	-16.30096749	-93.477965	-56.80033592	33.562475	22.32444058	100.2808	-13.16645065	-138.82875
29.75	-16.05155889	-97.622545	-59.57981733	67.751485	22.38390063	93.376195	-13.61296984	125.33905
30.00	-15.32192739	-100.70355	-57.29291052	81.110745	22.44783986	86.562925	-13.7665238	53.56833
30.25	-14.77973231	-105.3531	-55.59923561	74.754005	22.54764327	79.23272	-13.54761544	-18.27387
30.50	-13.90637243	-116.67795	-57.61449182	47.392435	22.62592452	71.516505	-13.61825768	-93.348435
30.75	-14.07337425	-122.66005	-60.04382196	12.979895	22.56039662	64.592015	-14.09952685	-130.42545
31.00	-13.88922339	-126.7588	-58.0366743	73.236565	22.69293665	57.867635	-14.44023976	122.49695
31.25	-13.26397117	-133.0622	-60.14698201	37.98453	22.78062193	50.275355	-14.44422405	47.336625
31.50	-13.16452432	-140.3916	-60.46252664	-15.40174	22.80738428	42.751065	-14.80093411	-27.465895
31.75	-13.6095979	-146.25725	-56.0668128	-115.37255	22.79097583	36.00424	-15.67019476	-102.7259
32.00	-13.07285879	-150.56895	-53.29910373	-1.6911485	22.93177686	28.53505	-16.23041144	-116.98635
32.25	-12.50657954	-156.03845	-52.75608826	132.09635	23.0506993	20.88901	-16.82205653	116.41835
32.50	-12.05340239	-161.93825	-52.62143804	128.2354	23.12964032	13.03169	-16.7656923	46.14878
32.75	-11.90808314	-165.0278	-51.93862005	132.9267	23.18981148	5.3307895	-17.13767081	-24.8769
33.00	-11.59851585	-152.62485	-49.88217441	138.3007	23.29745264	-2.7497245	-17.33933361	-96.674765
33.25	-11.37942665	164.94165	-48.83793104	143.50805	23.35467821	-10.64075	-17.95718956	-138.23915
33.50	-11.07437259	163.78545	-47.14877265	140.51125	23.40612905	-19.23941	-17.67557947	125.75565
33.75	-10.47260216	159.1624	-46.26632447	128.96525	23.42824267	-27.505455	-17.12847735	53.3983
34.00	-10.50876262	153.97935	-48.27127485	115.4357	23.25587256	-35.667295	-16.45238714	-25.603715
34.25	-10.40440512	148.05495	-48.8996033	118.68215	23.2969827	-43.740335	-16.63057827	-101.2108
34.50	-10.25392234	142.59805	-48.47291046	120.31615	23.34899926	-51.635875	-16.80320123	-114.21545
34.75	-9.95351944	135.58455	-48.55630728	115.61975	23.31100204	-61.13331	-16.0578984	114.59085
35.00	-9.7801829	129.55605	-49.08089355	112.51405	23.28224291	-68.76975	-15.78850854	33.6834
35.25	-9.363796959	124.9587	-47.71441858	120.1152	23.27909272	-77.655345	-15.84393601	-42.121665
35.50	-9.044097738	119.4332	-47.52514649	111.25935	23.25129438	-86.18715	-15.30254521	-120.2415
35.75	-8.966490885	112.0195	-48.65580777	113.17645	23.28798951	-94.435785	-15.12525772	122.55345
36.00	-8.834145542	108.24685	-47.4971327	114.9663	23.25081107	-103.5089	-15.03074603	85.048915
36.25	-8.674416856	104.4234	-46.68030708	115.6489	23.42256055	-112.7956	-14.85363559	9.9108795
36.50	-8.242578634	100.66145	-45.33213483	112.5023	23.43027722	-123.8212	-13.56642284	-62.39453
36.75	-7.83220589	95.463445	-45.10567231	99.39984	23.44833736	-133.02525	-12.63325706	-124.26955
37.00	-7.608324013	91.195565	-45.86158675	100.5199	23.53872449	-143.6121	-12.26129823	125.03845
37.25	-7.326308688	88.696615	-45.09405273	103.4801	23.57787171	-154.6609	-10.88711877	66.016285
37.50	-6.893970738	83.71637	-44.29659493	94.82308	23.56362656	-150.65565	-9.680515746	-17.99208
37.75	-6.485416526	79.78105	-44.1998834	91.879195	23.4026921	148.67915	-8.60806281	-95.16823
38.00	-6.274724758	77.38159	-44.03323757	84.794345	23.39619401	153.00565	-7.935489455	-118.68685

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## S-Parameters (cont.)

Typical S-Parameter Data for XB1006  
Vd=5.5 V Id1=50 mA Id2=50 mA

Frequency (GHz)	S11 Mag dB	S11 Phase Ang°	S12 Mag dB	S12 Phase Ang°	S21 Mag dB	S21 Phase Ang°	S22 Mag dB	S22 Phase Ang°
16.000	-3.543334474	53.128425	-51.27268862	160.5374	18.33300577	156.1343	-12.53000719	50.020395
16.125	-3.543334474	53.128425	-51.27268862	160.5374	18.33300577	156.1343	-12.53000719	50.020395
16.250	-3.666919789	134.90655	-51.24159485	160.4555	18.44889572	153.55905	-12.61718077	116.3095
16.375	-3.947485572	172.33845	-51.011666321	160.00475	18.67314866	148.4077	-12.75722316	124.451
16.500	-4.257494299	170.6402	-50.78760653	157.76265	18.88012881	143.1932	-12.85386541	92.49176
16.625	-4.577508351	167.1688	-50.77319362	155.0547	19.07480485	138.05505	-12.92702128	58.096495
16.750	-5.091115964	161.54285	-50.7762499	152.6968	19.34568732	130.3197	-13.01542862	6.081978
16.875	-5.491460887	157.68635	-50.77786582	149.77815	19.50846536	125.16075	-13.07847526	-28.760405
17.000	-5.906604397	153.9697	-51.07813117	148.5859	19.66834861	120.0839	-13.16973847	-63.579195
17.125	-6.333462459	149.991	-51.15929092	148.4044	19.82012464	114.95805	-13.26924423	-98.20622
17.250	-6.789578866	145.82685	-51.09028607	147.74965	19.95882856	109.8493	-13.31684735	-124.79615
17.375	-7.268953371	141.5352	-51.00837934	147.10685	20.07661964	104.7852	-13.35776413	-42.379825
17.500	-7.802696376	137.24875	-50.81011296	145.7922	20.18007588	99.862865	-13.3742576	115.0005
17.625	-8.364308634	132.7571	-50.59582036	144.035	20.28295505	94.97222	-13.33387107	122.74425
17.750	-8.964887376	128.0907	-50.37964862	140.41685	20.37062253	90.12685	-13.27239878	88.302995
17.875	-9.588720546	123.48785	-50.52666423	136.2704	20.45642314	85.38763	-13.26347087	52.932595
18.000	-10.22808499	118.55875	-50.78563026	135.685	20.53801015	80.733455	-13.27010449	17.8352
18.125	-10.91442113	113.2874	-50.58982663	134.03495	20.62205856	76.116835	-13.19648893	-17.40267
18.250	-12.02372258	105.081	-50.83211097	125.38215	20.73452407	69.208555	-13.22177658	-71.090805
18.375	-12.74582521	99.0806	-51.70995112	124.2938	20.80768804	64.64094	-13.28470597	-106.27955
18.500	-13.46739057	92.226705	-51.97640046	126.2598	20.87025773	60.09046	-13.28201673	-131.26315
18.625	-14.2797117	85.032335	-51.81864148	124.83045	20.92088974	55.64265	-13.25807806	-49.504285
18.750	-15.12117876	77.60725	-52.04552408	121.56355	20.98795918	51.30391	-13.22505939	106.858
18.875	-15.84642289	69.65264	-52.60911	120.5673	21.06014387	46.879275	-13.20510367	112.4717
19.000	-16.49218438	60.693055	-52.74856383	122.5152	21.1032617	42.46012	-13.15947673	77.05159
19.125	-17.15693005	50.82941	-52.49023944	119.6957	21.15791902	38.133045	-13.15667357	40.911265
19.250	-17.62677675	41.19882	-53.27293883	115.93445	21.20279335	33.719345	-13.21481934	5.627159
19.375	-17.84214237	30.96064	-53.81520913	117.8715	21.23068794	29.44139	-13.15433031	-29.51757
19.500	-17.99257314	20.597685	-53.93814929	117.30655	21.25734418	25.18205	-13.1195674	-65.09677
19.625	-17.87177072	10.20781	-54.51897041	117.8501	21.28441134	21.04184	-13.09236673	-100.59855
19.750	-17.53401696	-5.722246	-54.72540321	121.7078	21.35122201	14.89387	-12.99568776	-111.87725
19.875	-17.37079562	-14.566025	-54.63758587	122.50805	21.37380691	10.74832	-12.98276301	44.34761
20.000	-17.0925618	-22.492715	-54.7127099	121.4324	21.40120918	6.6682405	-12.96663566	125.64495
20.125	-16.72948077	-29.131525	-55.43049852	121.60025	21.42479897	2.581418	-12.93345459	98.609815
20.250	-16.26566985	-35.77474	-55.46490214	127.51435	21.44164247	-1.4060535	-12.87591939	62.7217
20.375	-15.89813716	-42.7789	-55.14669964	128.5237	21.4661167	-5.382533	-12.87868117	26.948795
20.500	-15.57382526	-49.00786	-55.00982959	128.00225	21.50181186	-9.403233	-12.88022724	-8.7853955
20.625	-15.35480861	-54.768445	-55.09443704	125.92595	21.52008758	-13.516385	-12.94176551	-44.338
20.750	-15.19832979	-59.258895	-55.87629898	126.6779	21.50400933	-17.43509	-12.93841714	-79.39115
20.875	-14.97358474	-63.457595	-56.10702485	130.41705	21.5058218	-21.32193	-12.83635505	-114.78585
21.000	-14.78091526	-67.169825	-56.48204806	134.69955	21.50140608	-25.22435	-12.75393276	-108.1275
21.125	-14.51352789	-70.868345	-56.16099097	143.1155	21.49880598	-28.96836	-12.65618689	48.12609
21.250	-14.19641598	-77.409575	-54.09859429	146.7013	21.52488964	-34.683675	-12.59635296	119.77755
21.375	-14.19647665	-81.508425	-53.3570701	139.98635	21.51102959	-38.617655	-12.6349827	83.974185
21.500	-14.26436814	-83.784905	-54.01043617	133.97195	21.47238314	-42.242495	-12.65534316	48.72413
21.625	-14.10595825	-84.9867	-55.28507219	140.4089	21.4635233	-45.62981	-12.55914765	13.645015
21.750	-13.75735804	-88.03732	-53.85581469	152.23165	21.49371655	-49.231985	-12.48387837	-22.516115
21.875	-13.61681041	-92.36858	-52.12541735	148.7332	21.50509696	-52.99611	-12.55063454	-58.43523
22.000	-13.64557356	-96.408495	-51.33705923	142.4016	21.49447912	-56.683695	-12.60279026	-93.76673
22.125	-13.81836577	-99.26957	-51.33561566	135.13285	21.46502232	-60.32387	-12.62812969	-121.65225
22.250	-13.85349443	-100.9768	-51.81366612	134.57605	21.45927959	-63.627225	-12.49088541	-39.256035
22.375	-13.74160943	-103.1917	-51.16667546	135.53175	21.48961108	-66.98402	-12.37123679	117.06315
22.500	-13.80451768	-106.3348	-50.70036342	127.495	21.50059923	-70.574705	-12.41934776	123.7329
22.625	-13.86980758	-108.1003	-51.66101097	121.60345	21.49110727	-74.03155	-12.40536092	90.17866
22.750	-13.91883856	-110.33155	-52.55117959	125.92505	21.51251686	-79.005535	-12.21666077	37.69285
22.875	-13.85986278	-112.9094	-52.36395327	129.0922	21.55480974	-82.422955	-12.0993599	1.7223855
23.000	-13.8979534	-115.5977	-51.9397174	130.15935	21.57874948	-86.059995	-12.03596495	-34.07807
23.125	-13.97465278	-117.84515	-51.64341454	129.94485	21.58652443	-89.609445	-11.97691372	-69.87784
23.250	-14.00292799	-120.01485	-51.09797204	130.93345	21.61126464	-93.17945	-11.96206474	-106.02645
23.375	-14.14953948	-123.23065	-49.95395592	127.96625	21.61210098	-96.8759	-12.05358495	-133.1404
23.500	-14.51775974	-125.32675	-49.72214536	117.24785	21.56533191	-100.35685	-12.15870459	-50.46395
23.625	-14.72778835	-125.87575	-50.99022235	111.96855	21.57023675	-103.50015	-12.00500883	107.20185
23.750	-14.72837031	-127.48435	-51.63995526	116.8559	21.62078866	-106.9533	-11.83007995	113.39185
23.875	-14.88743634	-130.23745	-50.93850852	118.2655	21.60544716	-110.6568	-11.89467832	77.397345

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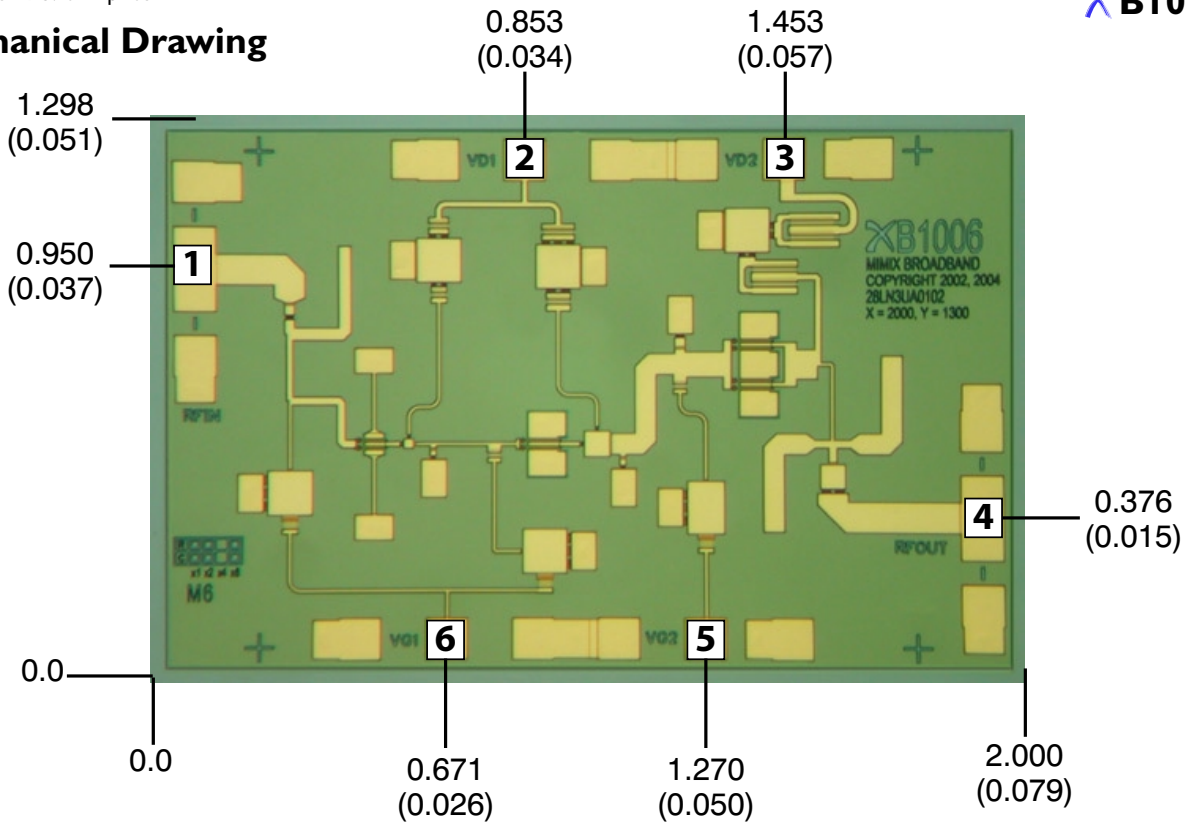


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**XB1006**

## Mechanical Drawing

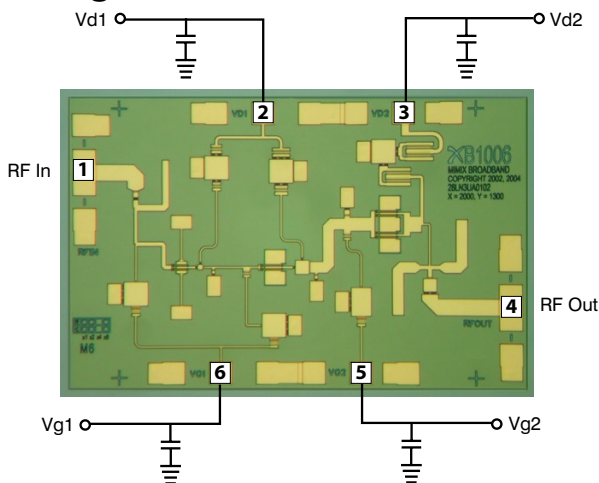


(Note: Engineering designator is 28LN3UA0102)

Units: millimeters (inches) Bond pad dimensions are shown to center of bond pad.  
 Thickness: 0.110 +/- 0.010 (0.0043 +/- 0.0004), Backside is ground, Bond Pad/Backside Metallization: Gold  
 All DC Bond Pads are 0.100 x 0.100 (0.004 x 0.004). All RF Bond Pads are 0.100 x 0.200 (0.004 x 0.008)  
 Bond pad centers are approximately 0.109 (0.004) from the edge of the chip.  
 Dicing tolerance: +/- 0.005 (+/- 0.0002). Approximate weight: 1.612 mg.

Bond Pad #1 (RF In)	Bond Pad #3 (Vd2)	Bond Pad #5 (Vg2)
Bond Pad #2 (Vd1)	Bond Pad #4 (RF Out)	Bond Pad #6 (Vg1)

## Bias Arrangement



**Bypass Capacitors** - See App Note [2]

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**App Note [1] Biasing** - As shown in the bonding diagram, this device can be operated with all three stages in parallel, and can be biased for low noise performance or high power performance. Low noise bias is nominally  $V_d=3.5V, I_d=50mA$ . More controlled performance will be obtained by separately biasing  $V_{d1}$  and  $V_{d2}$  each at 3.5V, 25mA. Power bias may be as high as  $V_d=5.5V, I_d=100mA$  with all stages in parallel, or most controlled performance will be obtained by separately biasing  $V_{d1}$  and  $V_{d2}$  each at 5.5V, 50mA. It is also recommended to use active biasing to keep the currents constant as the RF power and temperature vary; this gives the most reproducible results. Depending on the supply voltage available and the power dissipation constraints, the bias circuit may be a single transistor or a low power operational amplifier, with a low value resistor in series with the drain supply used to sense the current. The gate of the pHEMT is controlled to maintain correct drain current and thus drain voltage. The typical gate voltage needed to do this is -0.3V. Typically the gate is protected with Silicon diodes to limit the applied voltage. Also, make sure to sequence the applied voltage to ensure negative gate bias is available before applying the positive drain supply.

**App Note [2] Bias Arrangement** -

For Parallel Stage Bias (Recommended for general applications) -- The same as Individual Stage Bias but all the drain or gate pad DC bypass capacitors (~100-200 pf) can be combined. Additional DC bypass capacitance (~0.01 uF) is also recommended to all DC or combination (if gate or drains are tied together) of DC bias pads.

For Individual Stage Bias (Recommended for saturated applications) -- Each DC pad ( $V_{d1,2}$  and  $V_{g1,2}$ ) needs to have DC bypass capacitance (~100-200 pf) as close to the device as possible. Additional DC bypass capacitance (~0.01 uF) is also recommended.

## MTTF Tables

These numbers were calculated based on accelerated life test information and thermal model analysis received from the fabricating foundry.

Backplate Temperature	Channel Temperature	Rth	MTTF Hours	FITs
55 deg Celsius	83.0 deg Celsius	159.9° C/W	8.28E+10	1.21E-02
75 deg Celsius	105.1 deg Celsius	171.9° C/W	5.33E+09	1.88E-01
95 deg Celsius	127.0 deg Celsius	182.6° C/W	4.75E+08	2.11E+00

**Bias Conditions:**  $V_{d1}=V_{d2}=3.5V, I_{d1}=25 mA, I_{d2}=25 mA$

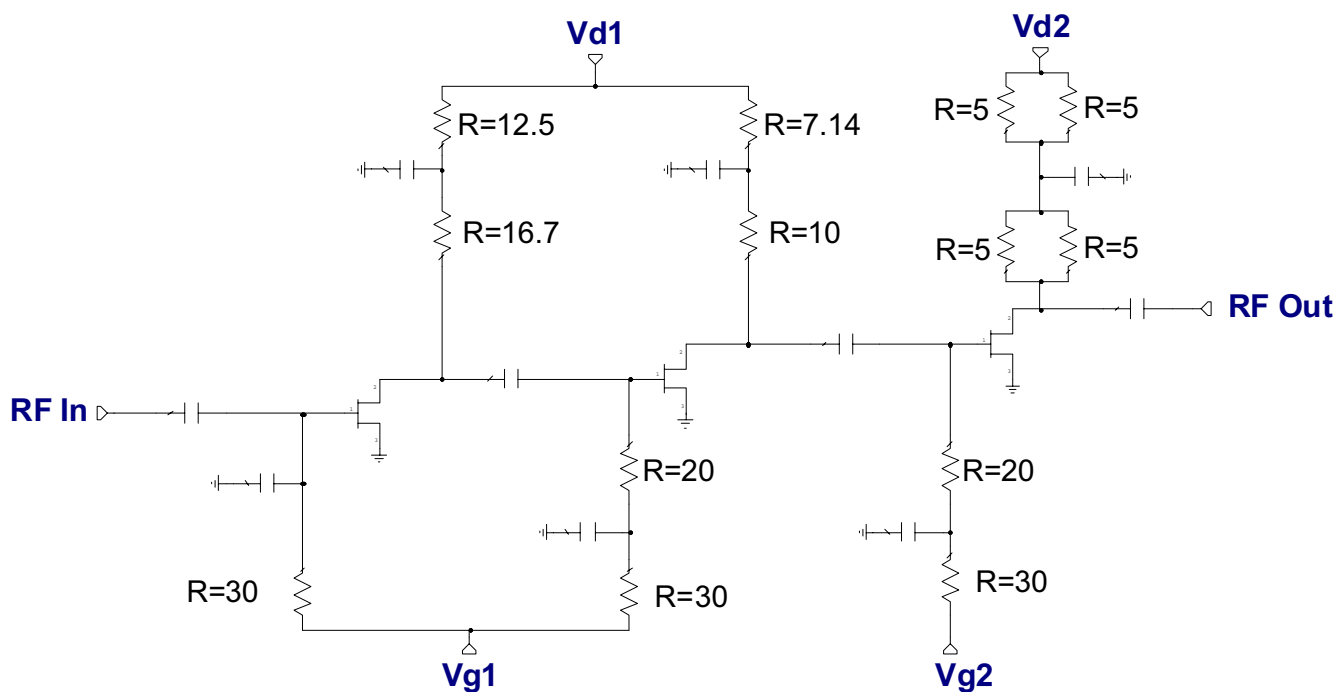
Backplate Temperature	Channel Temperature	Rth	MTTF Hours	FITs
55 deg Celsius	149.1 deg Celsius	171.2° C/W	8.14E+07	1.23E+01
75 deg Celsius	175.4 deg Celsius	182.5° C/W	7.93E+06	1.26E+02
95 deg Celsius	201.0 deg Celsius	192.8° C/W	1.04E+06	9.63E+02

**Bias Conditions:**  $V_{d1}=V_{d2}=5.5V, I_{d1}=50 mA, I_{d2}=50 mA$

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## Device Schematic



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## Handling and Assembly Information

**CAUTION!** - Mimix Broadband MMIC Products contain gallium arsenide (GaAs) which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- *Do not ingest.*
- *Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.*
- *Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.*

**Life Support Policy** - Mimix Broadband's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President and General Counsel of Mimix Broadband. As used herein: (1) Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user. (2) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**ESD** - Gallium Arsenide (GaAs) devices are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic containers, which should be opened in cleanroom conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickups or, with care, sharp tweezers.

**Die Attachment** - GaAs Products from Mimix Broadband are 0.100 mm (0.004") thick and have vias through to the backside to enable grounding to the circuit. Microstrip substrates should be brought as close to the die as possible. The mounting surface should be clean and flat. If using conductive epoxy, recommended epoxies are Ablestick 84-1LMI or 84-1LMIT cured in a nitrogen atmosphere per manufacturer's cure schedule. Apply epoxy sparingly to avoid getting any on to the top surface of the die. An epoxy fillet should be visible around the total die periphery. If eutectic mounting is preferred, then a fluxless gold-tin (AuSn) preform, approximately 0.001<sup>2</sup> thick, placed between the die and the attachment surface should be used. A die bonder that utilizes a heated collet and provides scrubbing action to ensure total wetting to prevent void formation in a nitrogen atmosphere is recommended. The gold-tin eutectic (80% Au 20% Sn) has a melting point of approximately 280°C (Note: Gold Germanium should be avoided). The work station temperature should be 310°C ± 10°C. Exposure to these extreme temperatures should be kept to minimum. The collet should be heated, and the die pre-heated to avoid excessive thermal shock. Avoidance of air bridges and force impact are critical during placement.

**Wire Bonding** - Windows in the surface passivation above the bond pads are provided to allow wire bonding to the die's gold bond pads. The recommended wire bonding procedure uses 0.076 mm x 0.013 mm (0.003" x 0.0005") 99.99% pure gold ribbon with 0.5-2% elongation to minimize RF port bond inductance. Gold 0.025 mm (0.001") diameter wedge or ball bonds are acceptable for DC Bias connections. Aluminum wire should be avoided. Thermo-compression bonding is recommended though thermosonic bonding may be used providing the ultrasonic content of the bond is minimized. Bond force, time and ultrasonics are all critical parameters. Bonds should be made from the bond pads on the die to the package or substrate. All bonds should be as short as possible.