

# DC-6.0 GHz InGaP HBT, MMIC or Packaged, Matched Gain Block Amplifier



May 2006 - Rev 23-May-06

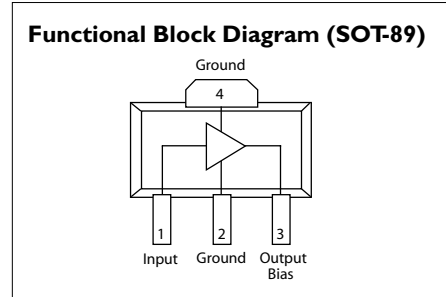
**CGB7003-SC (-BD)**  
RoHS

## Features

- ✕ Low Operating Voltage: 5V
- ✕ 31.5 dBm Output IP3 @ 850 MHz
- ✕ 2.9 dB Noise Figure @ 850 MHz
- ✕ 20.7 dB Gain @ 850 MHz
- ✕ 16.6 dBm P1dB @ 850 MHz
- ✕ Low Performance Variation Over Temperature
- ✕ Low Cost: Die Form or SOT-89 Package
- ✕ 100% DC On-Wafer Testing
- ✕ ESD Protection on All Die: >1000V HBM
- ✕ Low Thermal Resistance: <85°C/Watt

## Applications

- ✕ PA Driver Amp, IF Amp, LO Buffer Amp
- ✕ Cellular, PCS, GSM, UMTS
- ✕ Wireless Data and SATCOM
- ✕ Transmit and Receive Functions
- ✕ CATV



## Absolute Maximum Ratings

Max Device Voltage	+6.0 V
Max Device Current	130 mA
Max Device Dissipated Power	0.63 W
RF Input Power	+17 dBm
Storage Temperature	-55°C to 150°C
Junction Temperature	150°C
Operating Temperature	-40°C to +85°C
Thermal Resistance	85° C/W
EDS (HBM)	1000 V

Operation of this device above any of these parameters may cause permanent damage.

## Description

The CGB7003-SC (-BD) is a Darlington Configured, high dynamic range, utility gain block amplifier. Designed for applications operating within the DC to 6.0 GHz frequency range, Mimix's broadband, cascadable, gain block amplifiers are ideal solutions for transmit, receive and IF applications.

These MMIC amplifiers are available in bare die form or an industry standard SOT-89 package. Mimix's InGaP HBT technology and an industry low thermal resistance offers a

thermally robust and reliable gain block solution.

The InGaP HBT die have extra pads to enable thorough DC testing. This unique test capability and the inclusion of ESD protection on all die, significantly enhances the quality, reliability and ruggedness of these products.

With a single bypass capacitor, optional RF choke and two DC blocking capacitors, this gain block amplifier offers significant ease of use in a broad range of applications.

## Electrical Characteristics

Unless otherwise specified, the following specifications are guaranteed at room temperature in a Mimix test fixture.

Parameter	Temperature (°C)	850 MHz			1950 MHz			2400 MHz			3500 MHz			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Small Signal Gain	+25	19.5	20.7	21.9	16.8	18.0	19.2	15.8	17.0	18.2		15.2		dB
	-40 to +85	19.3	20.7	22.1	16.6	18.0	19.4	15.6	17.0	18.4		15.2		dB
Output P1dB	+25	15.6	16.6		14.4	15.4		13.2	14.2			11.3		dBm
	-40 to +85	15.0	16.6		14.0	15.4		12.8	14.2			11.3		dBm
Output IP3	+25	30.0	31.5		26.5	28.0		25.3	26.8			24.1		dBm
	-40 to +85	29.0	31.5		26.0	28.0		24.8	26.8			24.1		dBm
Noise Figure	+25		2.9	3.7		3.1	3.9		3.2	4.0		3.4		dB
	-40 to +85		2.9	4.0		3.1	4.2		3.2	4.3		3.4		dB
Operating Current	+25	46	50	54	46	50	54	46	50	54		50		mA
	-40 to +85	42	50	58	42	50	58	42	50	58		50		mA
Input Return Loss	+25	14.0	20.0		13.0	17.0		12.0	16.0			15.0		dB
	-40 to +85	13.0	20.0		12.0	17.0		11.0	16.0			15.0		dB
Output Return Loss	+25	17	25		13	18		14	19			15		dB
	-40 to +85	16	25		12	18		13	19			15		dB
Pout @ -45 dBc, ACP IS-95, 9 Forward Channels	+25		10.5			10.0								dBm
	-40 to +85		10.5			10.0								dBm

Notes: 1. Test Conditions in Mimix eval board, Vs = 5 V, Id = 35 mA Typ., Rbias = 20 Ω, Zs = Zl = 50 Ω, OIP3 tone spacing = 1 MHz, Pout per tone = 3 dBm.  
2. Values reflect performance in recommended application circuit.

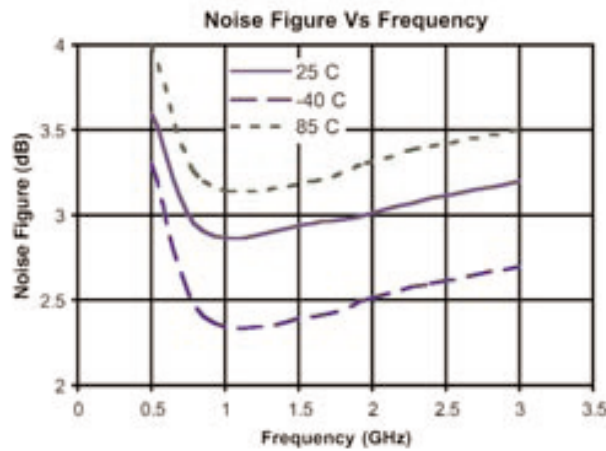
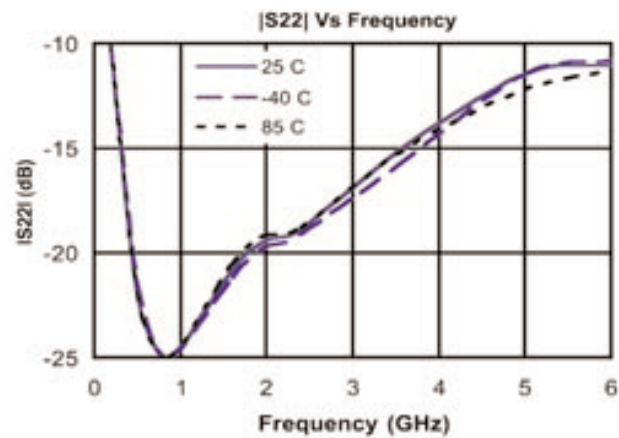
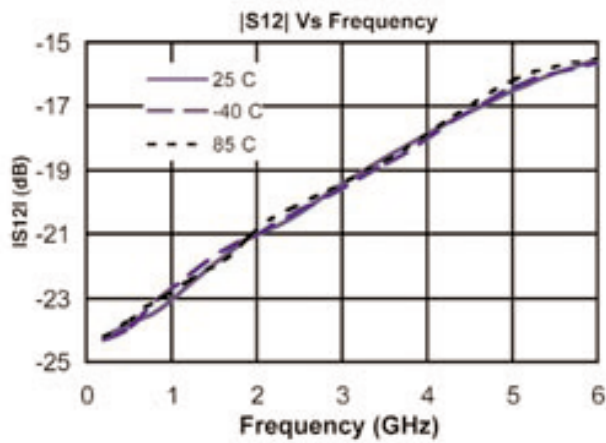
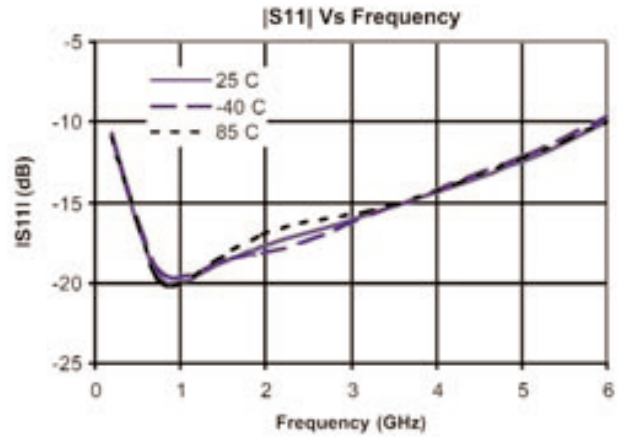
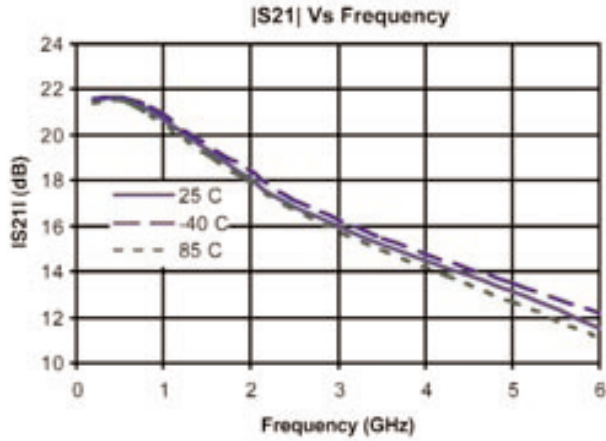
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## Typical S-Parameter and Noise Performance



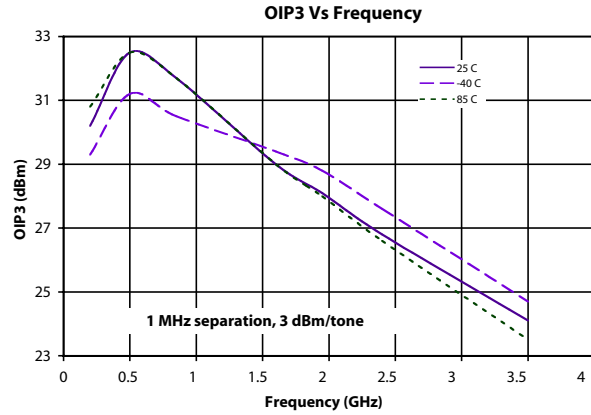
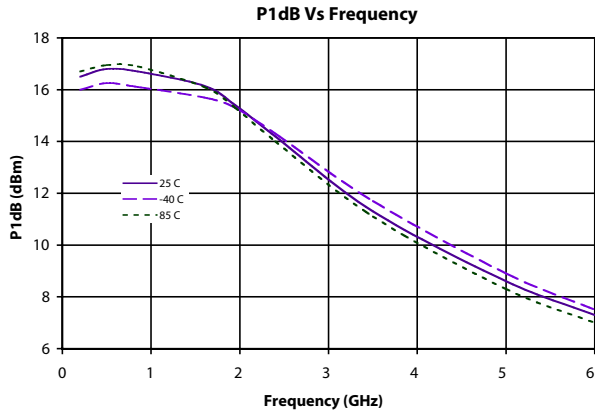
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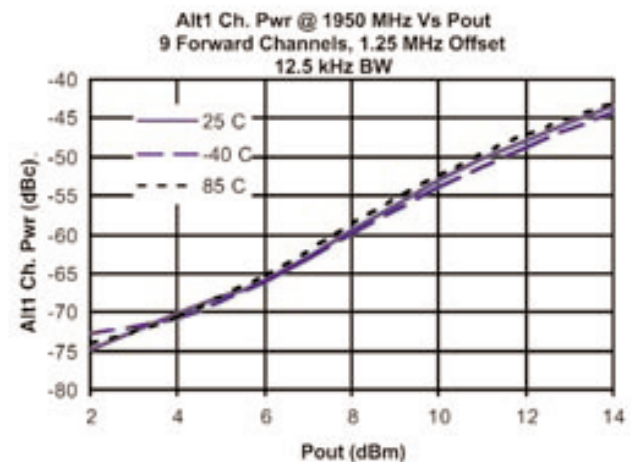
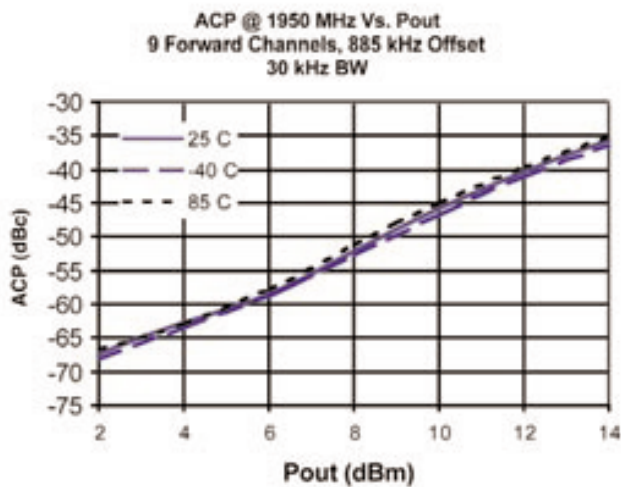
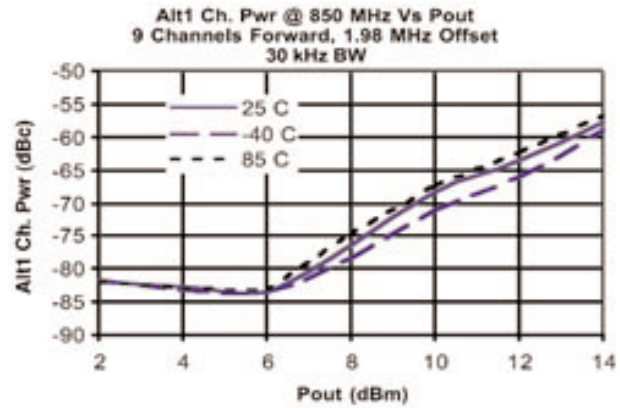
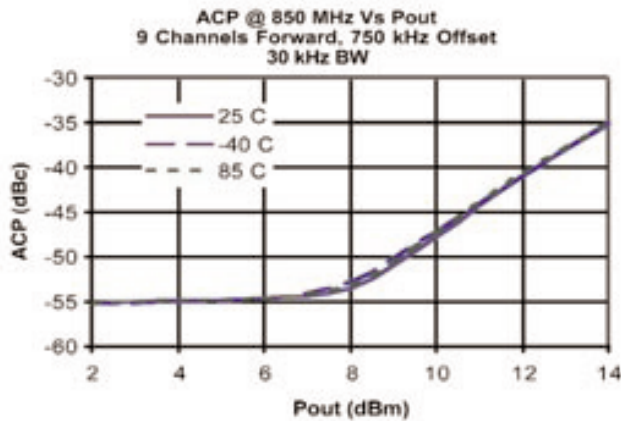
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## Typical Power and Linearity Performance



## Linearity Performance - Base Station ACP - IS-95



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## Typical Scattering Parameters (Vd = +4.07V, Icc = 51.5 mA, T = 23°C, device in a 50 ohm system)

Frequency (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)
100	0.027	-170.5	12.72	173.4	0.065	0.3	0.012	-73.2
200	0.028	-158.2	12.61	166.8	0.066	-0.2	0.023	-87.3
300	0.032	-149.4	12.50	160.4	0.066	0.1	0.034	-96.8
400	0.035	-143.6	12.35	154.0	0.066	-0.2	0.044	-103.8
500	0.040	-138.0	12.16	147.8	0.067	-0.1	0.055	-109.9
600	0.045	-134.7	11.96	141.6	0.068	-0.3	0.064	-115.8
700	0.051	-133.1	11.74	135.6	0.069	-0.5	0.073	-121.8
800	0.056	-132.5	11.50	129.6	0.070	-0.8	0.082	-127.0
900	0.062	-131.4	11.26	123.8	0.071	-1.2	0.090	-131.9
1000	0.069	-132.2	11.01	118.1	0.072	-1.7	0.097	-137.2
1100	0.075	-132.5	10.75	112.5	0.074	-2.2	0.104	-142.2
1200	0.081	-133.4	10.49	107.0	0.075	-2.9	0.109	-146.9
1300	0.087	-134.7	10.22	101.6	0.077	-3.6	0.114	-151.5
1400	0.093	-136.0	9.95	96.3	0.078	-4.4	0.119	-155.9
1500	0.099	-137.4	9.70	91.1	0.080	-5.2	0.123	-160.1
1600	0.106	-139.2	9.45	86.0	0.082	-6.2	0.126	-164.4
1700	0.112	-140.9	9.20	81.0	0.084	-7.2	0.129	-168.2
1800	0.118	-142.6	8.95	76.1	0.085	-8.4	0.132	-172.3
1900	0.124	-144.7	8.72	71.4	0.087	-9.5	0.133	-176.2
2000	0.129	-146.7	8.50	66.7	0.089	-10.8	0.135	-179.8
2100	0.135	-149.0	8.28	62.0	0.091	-12.1	0.136	-176.1
2200	0.140	-151.0	8.06	57.4	0.094	-13.5	0.137	-172.3
2300	0.146	-153.5	7.86	52.9	0.096	-15.0	0.138	-168.7
2400	0.151	-156.0	7.66	48.4	0.098	-16.5	0.139	-164.9
2500	0.155	-158.5	7.48	44.0	0.100	-18.1	0.139	-161.2
2600	0.159	-161.2	7.29	39.7	0.102	-19.7	0.139	-157.4
2700	0.163	-163.8	7.12	35.4	0.104	-21.4	0.139	-153.5
2800	0.167	-166.5	6.96	31.2	0.107	-23.1	0.140	-149.9
2900	0.171	-169.5	6.80	27.0	0.109	-24.9	0.141	-146.2
3000	0.174	-172.3	6.65	22.8	0.111	-26.7	0.141	-142.5
3100	0.178	-175.2	6.51	18.7	0.114	-28.5	0.142	-138.9
3200	0.181	-178.2	6.37	14.6	0.116	-30.5	0.143	-135.0
3300	0.185	-178.4	6.24	10.5	0.119	-32.5	0.144	-131.3
3400	0.189	-175.1	6.12	6.4	0.121	-34.5	0.145	-127.4
3500	0.192	-171.8	6.00	2.4	0.124	-36.6	0.147	-123.6
3600	0.195	-168.4	5.88	-1.7	0.126	-38.7	0.148	-119.8
3700	0.198	-164.7	5.77	-5.7	0.128	-40.8	0.150	-115.8
3800	0.201	-161.0	5.66	-9.7	0.131	-43.0	0.153	-111.7
3900	0.204	-156.9	5.56	-13.7	0.134	-45.2	0.156	-107.7
4000	0.206	-152.8	5.46	-17.7	0.136	-47.4	0.159	-103.4
4100	0.209	-148.6	5.37	-21.7	0.138	-49.8	0.163	-99.1
4200	0.210	-144.3	5.27	-25.6	0.141	-52.1	0.168	-94.9
4300	0.211	-139.5	5.18	-29.6	0.144	-54.5	0.173	-90.5
4400	0.213	-134.6	5.10	-33.6	0.146	-56.9	0.179	-86.0
4500	0.215	-129.5	5.01	-37.6	0.148	-59.3	0.185	-81.3
4600	0.216	-124.6	4.93	-41.5	0.151	-61.8	0.192	-77.0
4700	0.217	-119.5	4.85	-45.5	0.153	-64.3	0.200	-72.8
4800	0.218	-114.0	4.78	-49.5	0.156	-66.9	0.208	-68.5
4900	0.221	-108.1	4.70	-53.5	0.158	-69.5	0.218	-64.1
5000	0.224	-102.1	4.63	-57.6	0.160	-72.2	0.229	-59.7

Continues Next Page. S-Parameter Data Files are available on-line at: [www.mimixbroadband.com](http://www.mimixbroadband.com)

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Frequency (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)
5100	0.227	96.4	4.55	-61.6	0.163	-74.8	0.239	55.4
5200	0.229	90.7	4.48	-65.6	0.165	-77.5	0.249	51.3
5300	0.232	84.7	4.42	-69.6	0.167	-80.3	0.260	47.2
5400	0.237	78.2	4.35	-73.7	0.169	-83.1	0.273	42.8
5500	0.243	71.7	4.27	-77.8	0.171	-85.9	0.286	38.5
5600	0.249	65.5	4.21	-81.8	0.173	-88.7	0.299	34.4
5700	0.255	59.4	4.14	-85.9	0.175	-91.7	0.313	30.5
5800	0.262	53.2	4.07	-90.1	0.177	-94.6	0.327	26.2
5900	0.269	46.5	4.00	-94.3	0.178	-97.6	0.343	22.0
6000	0.279	40.0	3.93	-98.4	0.179	-100.6	0.359	17.9
6100	0.290	33.9	3.86	-102.5	0.181	-103.6	0.376	13.8
6200	0.300	27.9	3.79	-106.7	0.182	-106.6	0.393	9.9
6300	0.310	21.9	3.72	-110.9	0.183	-109.7	0.409	6.0
6400	0.321	15.7	3.64	-115.0	0.183	-112.8	0.426	2.1
6500	0.333	9.7	3.57	-119.2	0.184	-115.9	0.444	-1.8
6600	0.347	4.1	3.49	-123.4	0.184	-118.9	0.462	-5.6
6700	0.360	-1.1	3.42	-127.5	0.184	-122.0	0.478	-9.3
6800	0.372	-6.4	3.34	-131.7	0.184	-125.1	0.496	-12.9
6900	0.384	-11.7	3.27	-135.8	0.184	-128.3	0.512	-16.5
7000	0.397	-17.1	3.19	-139.9	0.184	-131.4	0.530	-20.2
7100	0.411	-22.2	3.11	-144.0	0.183	-134.5	0.546	-23.7
7200	0.425	-27.0	3.03	-148.1	0.182	-137.5	0.562	-27.4
7300	0.437	-31.6	2.95	-152.1	0.181	-140.6	0.576	-30.8
7400	0.448	-36.3	2.88	-156.2	0.180	-143.6	0.591	-34.2
7500	0.460	-41.1	2.80	-160.2	0.179	-146.7	0.605	-37.7
7600	0.473	-45.7	2.72	-164.1	0.177	-149.8	0.620	-41.1
7700	0.486	-50.0	2.64	-168.1	0.175	-152.7	0.634	-44.5
7800	0.497	-54.0	2.57	-171.9	0.174	-155.6	0.646	-47.8
7900	0.506	-58.0	2.49	-175.7	0.172	-158.4	0.658	-50.9
8000	0.515	-62.2	2.42	-179.5	0.170	-161.2	0.670	-54.0
8100	0.526	-66.3	2.35	-176.7	0.168	-164.1	0.681	-57.1
8200	0.537	-70.2	2.27	-173.0	0.166	-167.0	0.693	-60.2
8300	0.546	-73.6	2.20	-169.4	0.164	-169.6	0.703	-63.1
8400	0.553	-77.0	2.14	-165.9	0.161	-172.2	0.712	-65.9
8500	0.559	-80.5	2.08	-162.4	0.159	-174.9	0.720	-68.7
8600	0.565	-84.2	2.01	-158.8	0.157	-177.6	0.728	-71.4
8700	0.573	-87.7	1.95	-155.3	0.155	-179.8	0.736	-74.2
8800	0.579	-90.8	1.89	-152.0	0.152	-177.4	0.743	-76.8
8900	0.583	-93.7	1.83	-148.6	0.150	-175.1	0.749	-79.3
9000	0.585	-96.8	1.78	-145.3	0.149	-172.6	0.755	-81.7
9100	0.587	-100.1	1.72	-142.0	0.147	-170.1	0.759	-84.2
9200	0.591	-103.4	1.67	-138.6	0.144	-167.6	0.765	-86.6
9300	0.595	-106.4	1.62	-135.4	0.142	-165.3	0.770	-89.0
9400	0.597	-109.0	1.57	-132.2	0.140	-162.9	0.775	-91.4
9500	0.598	-111.8	1.53	-129.1	0.138	-160.7	0.778	-93.6
9600	0.597	-114.8	1.48	-125.9	0.136	-158.4	0.781	-95.8
9700	0.597	-117.8	1.44	-122.7	0.134	-156.0	0.784	-98.1
9800	0.600	-120.6	1.39	-119.6	0.131	-153.7	0.788	-100.3
9900	0.601	-123.1	1.35	-116.6	0.129	-151.6	0.791	-102.4
10000	0.601	-125.4	1.31	-113.7	0.127	-149.5	0.794	-104.5

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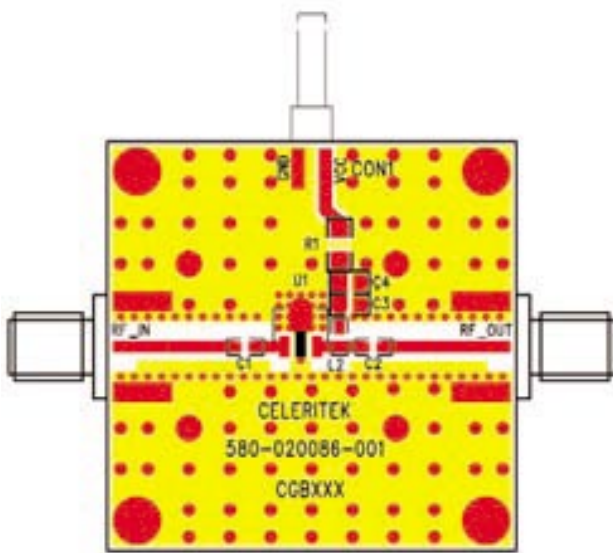
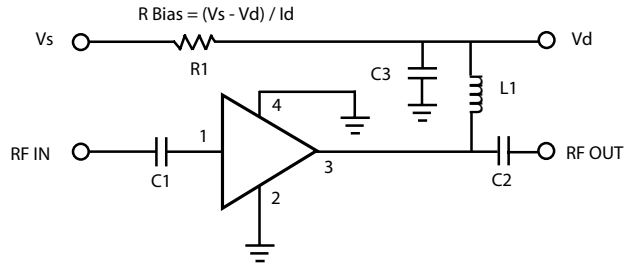
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## Application Circuit

Note: This schematic represents the topology of the application circuit recommended by Mimix.

Recommended Bias Resistor Values for $I_D = 35 \text{ mA}$						
Supply Voltage (V)	5V	6V	7V	8V	10V	12V
Rbias (R1 Description: 0805 1/8W 1%)	20Ω	39Ω	—	—	—	—
Rbias (R1 Description: 1206 1/4W 1%)	—	—	59Ω	78Ω	—	—
Rbias (R1 Description: 1210 1/2W 5%)	—	—	—	—	120Ω	160Ω

Note: Rbias provides DC bias stability over temperature.



Ref Designator	Value	Description	Size
C1, C2	1000 pF	MCH185A101JK	0805
C3	1.0 μF	VITR 1.0 μF 25V CER CAP 0805 X7R 10%	0805
L1	56 nH	Coilcraft 0603 CS 10%	0603
R1		R Bias = (Vs - Vd) / Id	0805 / 1206 / 1210
C4		DNP (Do Not Place)	N/A

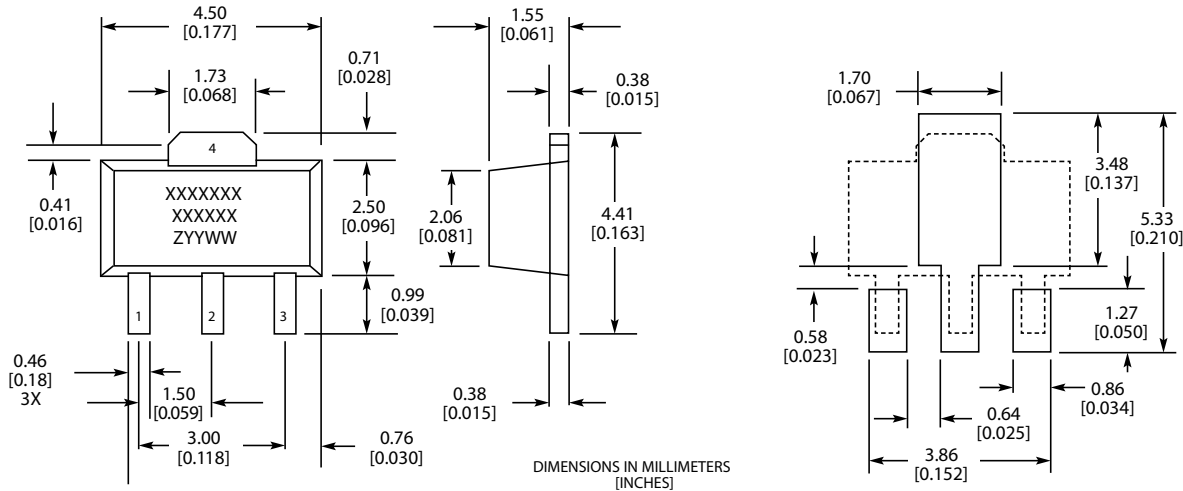
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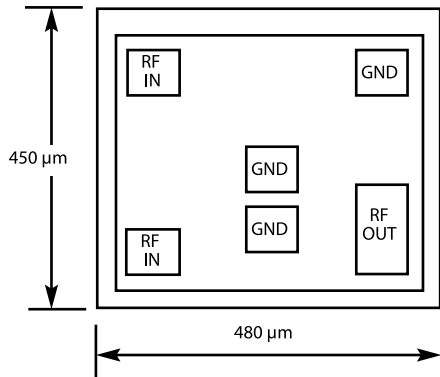
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## Physical Dimensions - SC Package (SOT-89)



MARKINGS:  
 XXXXXXX = MIMIX MODEL NO.  
 XXXXXX = WAFER LOT NO.  
 ZYYWW = DATE CODE (YR/WEEK)  
 FIRST LETTER COUNTRY OF ORIGIN IF OTHER THAN USA

## Physical Dimensions - BD (Bare Die)



Notes:  
 RF OUT bonding pad is 75 μm x 155 μm.  
 All other pads are 75 μm x 75 μm.



## Ordering Information

Part Number for Ordering	Description
CGB7003-BD	Bare die in GelPak
CGB7003-SC-0G00	Matte Tin plated RoHS compliant SOT-89 surface mount package in bulk quantity
CGB7003-SC-0G0T	Matte Tin plated RoHS compliant SOT-89 surface mount package in tape and reel
CGB7003-SP-0G00	Matte Tin plated RoHS compliant SOT-86 surface mount package in bulk quantity
CGB7003-SP-0G0T	Matte Tin plated RoHS compliant SOT-86 surface mount package in tape and reel
PB-CGB7003-SC-0000	Evaluation Board for SOT-89 packaged device with SMA connectors
PB-CGB7003-SP-0000	Evaluation Board for SOT-86 packaged device with SMA connectors

We also offer the plastic packages with SnPb (Tin-Lead) or NiPdAu plating. Please contact your regional sales manager for more information regarding different plating types

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