

DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier

Features

- ✕ 33.5 dBm Output IP3 @ 850 MHz
- ✕ 3.2 dB Noise Figure @ 850 MHz
- ✕ 21.2 dB Gain @ 850 MHz
- ✕ 18.8 dBm P1dB @ 850 MHz
- ✕ Low Performance Variation Over Temperature
- ✕ 100% DC On-Wafer Testing
- ✕ ESD Protection on All Die: >1000V HBM
- ✕ Low Thermal Resistance: <80°C/Watt

Description

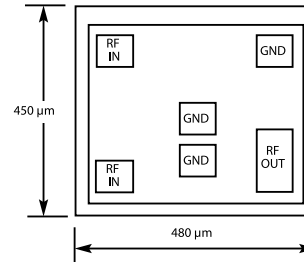
The CGB7008-BD is a Darlington Configured, high dynamic range, utility gain block amplifier. Designed for applications operating within the DC to 6.0 GHz frequency range, Mimix's broadband, cascadable, gain block amplifiers are ideal solutions for transmit, receive and IF applications.

These MMIC amplifiers are available in bare die form. 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.

Chip Layout



Absolute Maximum Ratings

Max Device Voltage	+6.0 V
Max Device Current	130 mA
Max Device Dissipated Power	0.65 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	80° C/W
ESD (HBM)	1000 V

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

Applications

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

Typical Performance

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	20.0	21.2	22.4	17.0	18.2	19.4	16.0	17.2	18.4		15.5		dB
	-40 to +85	19.8	21.2	22.6	16.8	18.2	19.6	15.8	17.2	18.6				dB
Output P1dB	+25	17.8	18.8		16.7	17.7		15.6	16.6			14.3		dBm
	-40 to +85	17.3	18.8		16.4	17.7		15.3	16.6					dBm
Output IP3	+25	32.0	33.5		30.0	31.5		29.0	30.5			27.5		dBm
	-40 to +85	31.5	33.5		29.5	31.5		28.5	30.5					dBm
Noise Figure	+25		3.2	4.0		3.2	4.0		3.4	4.2		3.5		dB
	-40 to +85		3.2	4.3		3.2	4.3		3.4	4.5				dB
Operating Current	+25	59	64	68	59	64	69	59	64	69		64		mA
	-40 to +85	55	64	73	55	64	73	55	64	73				mA
Input Return Loss	+25	14.0	19.0		11.0	16.0		10.0	16.0			14.0		dB
	-40 to +85	13.0	19.0		10.0	16.0		9.5	16.0					dB
Output Return Loss	+25	17.0	25.0		12.0	18.0		12.0	19.0			16.5		dB
	-40 to +85	16.0	25.0		11.0	18.0		11.0	19.0					dB
Pout @ -45 dBc, ACP IS-95, 9 Forward Channels	+25		13			13								dBm
	-40 to +85		13			13								dBm

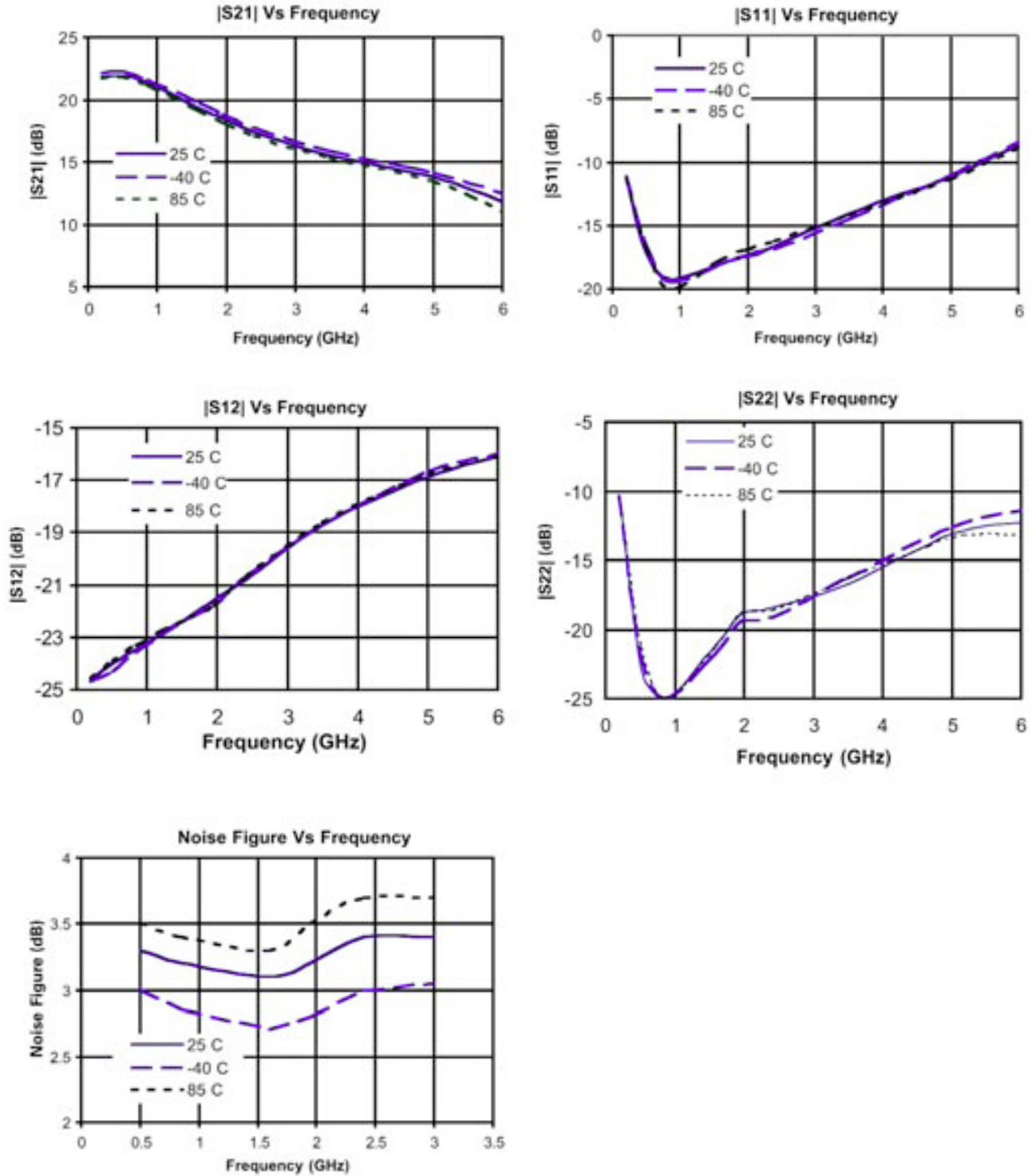
Notes: 1. Performance in Mimix eval board, $V_s = 8\text{ V}$, $I_d = 64\text{ mA Typ.}$, $R_{bias} = 47\ \Omega$, $Z_s = Z_L = 50\ \Omega$, OIP3 tone spacing = 1 MHz, Pout per tone = 3 dBm.
2. Values reflect performance in recommended application circuit.
3. Only on-wafer DC test is done. Devices are not tested for RF performance.

DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier

April 2007 - Rev 03-Apr-07

CGB7008-BD
RoHS

Typical S-Parameter and Noise Performance



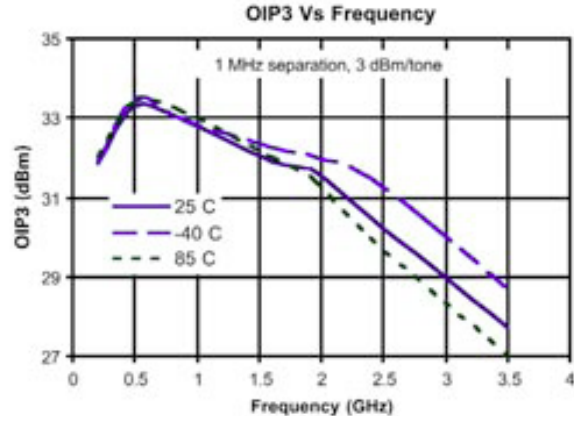
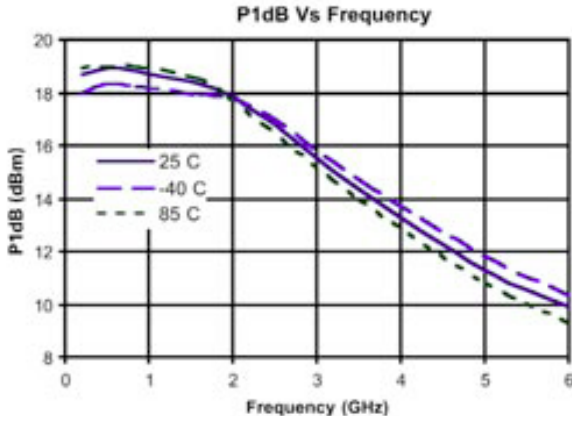
DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier



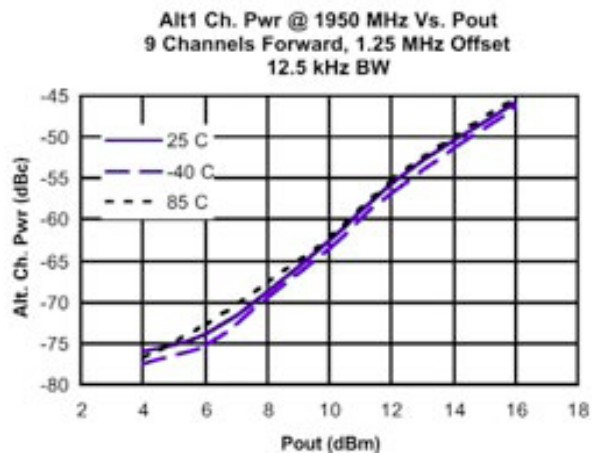
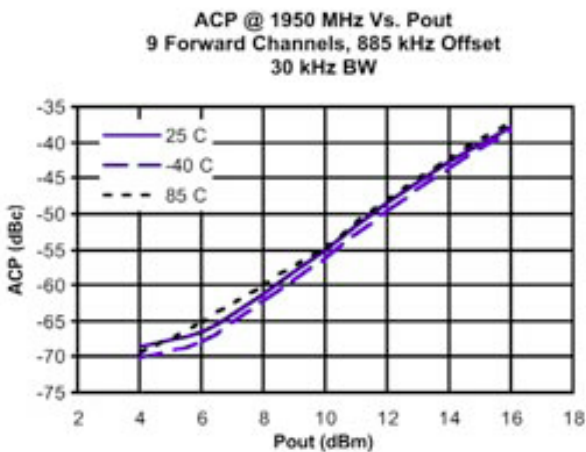
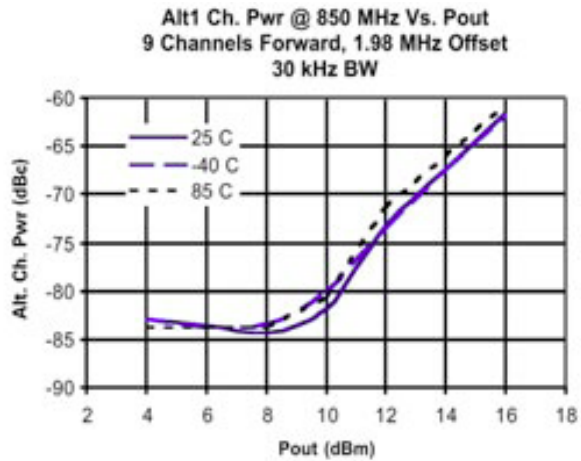
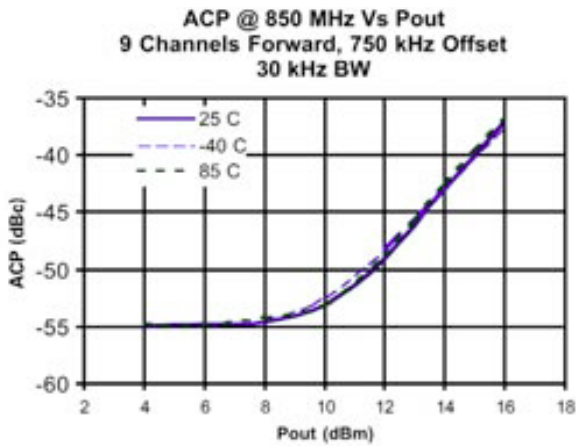
April 2007 - Rev 03-Apr-07

CGB7008-BD
RoHS

Typical Power and Linearity Performance



Linearity Performance - Base Station ACP - IS-95



DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier



April 2007 - Rev 03-Apr-07

CGB7008-BD
XRoHS

Typical Scattering Parameters (Vd = +5.15V, Icc = 64 mA, T = 23°C, device in a 50 ohm system)

Frequency (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)
100	0.025	-167.10	13.18	173.30	0.061	0.15	0.036	-22.61
200	0.028	-155.40	13.06	166.70	0.062	0.16	0.041	-42.62
300	0.033	-148.40	12.95	160.30	0.062	0.21	0.048	-60.35
400	0.038	-144.70	12.79	153.90	0.062	0.29	0.054	-73.53
500	0.043	-139.50	12.58	147.70	0.063	0.30	0.062	-83.95
600	0.049	-138.80	12.38	141.60	0.064	0.17	0.070	-94.01
700	0.056	-139.60	12.16	135.50	0.065	-0.03	0.078	-103.70
800	0.061	-140.00	11.91	129.60	0.066	-0.19	0.085	-110.90
900	0.068	-140.80	11.66	123.70	0.067	-0.62	0.093	-118.50
1000	0.075	-143.10	11.41	118.00	0.068	-1.14	0.100	-125.90
1100	0.081	-144.90	11.15	112.30	0.070	-1.65	0.107	-132.50
1200	0.087	-146.90	10.88	106.80	0.071	-2.28	0.112	-138.70
1300	0.093	-149.30	10.60	101.40	0.073	-3.05	0.118	-144.60
1400	0.098	-151.70	10.33	96.07	0.074	-3.83	0.123	-150.20
1500	0.104	-154.30	10.07	90.87	0.076	-4.88	0.128	-155.70
1600	0.110	-156.60	9.80	85.74	0.078	-5.72	0.132	-160.90
1700	0.115	-159.40	9.55	80.71	0.080	-6.78	0.137	-165.70
1800	0.122	-161.90	9.29	75.75	0.081	-8.05	0.141	-170.70
1900	0.127	-164.80	9.05	70.92	0.083	-9.21	0.145	-175.40
2000	0.132	-167.60	8.82	66.15	0.085	-10.54	0.148	179.70
2100	0.137	-170.50	8.59	61.39	0.087	-11.94	0.151	175.10
2200	0.141	-173.40	8.36	56.74	0.089	-13.42	0.153	170.50
2300	0.146	-176.50	8.14	52.18	0.091	-14.90	0.155	166.00
2400	0.150	-179.50	7.93	47.67	0.093	-16.43	0.157	161.80
2500	0.154	177.40	7.73	43.19	0.095	-18.15	0.160	157.30
2600	0.156	174.10	7.53	38.84	0.097	-19.77	0.160	152.80
2700	0.159	171.80	7.34	34.63	0.099	-21.41	0.160	149.10
2800	0.163	169.10	7.17	30.47	0.101	-22.95	0.162	145.60
2900	0.168	166.00	7.01	26.24	0.103	-24.77	0.166	141.90
3000	0.171	163.10	6.85	22.07	0.105	-26.54	0.167	138.20
3100	0.171	155.30	6.80	18.35	0.108	-28.33	0.169	135.00
3200	0.179	157.40	6.56	13.89	0.110	-30.29	0.172	131.30
3300	0.180	149.40	6.53	10.18	0.112	-32.31	0.176	128.00
3400	0.190	150.80	6.31	5.62	0.115	-34.36	0.180	124.30
3500	0.188	143.10	6.27	1.94	0.117	-36.48	0.182	120.50
3600	0.193	140.10	6.15	-2.09	0.119	-38.54	0.185	117.00
3700	0.198	137.10	6.03	-6.07	0.122	-40.71	0.188	113.70
3800	0.202	133.60	5.91	-10.12	0.124	-42.97	0.192	110.00
3900	0.207	130.00	5.80	-14.13	0.126	-45.23	0.196	106.40
4000	0.211	126.40	5.70	-18.13	0.128	-47.49	0.200	102.80
4100	0.216	123.10	5.59	-22.09	0.131	-49.85	0.204	99.38
4200	0.219	119.10	5.49	-26.09	0.133	-52.17	0.207	95.54
4300	0.223	114.90	5.40	-30.04	0.135	-54.54	0.212	92.05
4400	0.228	111.00	5.30	-34.00	0.137	-57.03	0.219	88.55
4500	0.231	106.80	5.21	-37.98	0.139	-59.49	0.224	84.77
4600	0.234	102.80	5.12	-41.89	0.141	-61.84	0.229	81.02
4700	0.238	98.85	5.04	-45.82	0.143	-64.27	0.235	77.75
4800	0.241	94.53	4.95	-49.76	0.145	-66.90	0.241	74.35
4900	0.245	89.93	4.88	-53.70	0.148	-69.39	0.249	70.79
5000	0.250	85.36	4.79	-57.68	0.150	-71.98	0.258	66.98

Continues Next Page. S-Parameter Data Files are available online at: www.mimixbroadband.com

Mimix Broadband, Inc., 10795 Rockley Rd., Houston, Texas 77099
Tel: 281.988.4600 Fax: 281.988.4615 mimixbroadband.com

Page 4 of 7

Characteristic Data and Specifications are subject to change without notice. ©2006 Mimix Broadband, Inc.
Export of this item may require appropriate export licensing from the U.S. Government. In purchasing these parts, U.S. Domestic customers accept their obligation to be compliant with U.S. Export Laws.

www.BDTIC.com/MACOM

DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier



April 2007 - Rev 03-Apr-07

CGB7008-BD
RoHS

Typical Scattering Parameters (Vd = +5.15V, Icc = 64 mA, T = 23°C, device in a 50 ohm system)

Frequency (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)
5100	0.252	81.28	4.71	-61.60	0.152	-74.61	0.264	63.35
5200	0.255	77.16	4.64	-65.46	0.154	-77.14	0.269	59.91
5300	0.259	72.79	4.58	-69.45	0.156	-79.78	0.277	56.70
5400	0.264	68.00	4.50	-73.45	0.157	-82.57	0.286	53.07
5500	0.269	63.35	4.43	-77.40	0.159	-85.30	0.294	49.57
5600	0.273	58.74	4.37	-81.33	0.161	-88.06	0.301	45.93
5700	0.278	54.29	4.30	-85.32	0.163	-90.74	0.311	42.59
5800	0.282	49.67	4.24	-89.42	0.165	-93.67	0.320	39.12
5900	0.286	44.39	4.17	-93.45	0.166	-96.62	0.328	35.33
6000	0.293	39.44	4.11	-97.46	0.167	-99.42	0.339	31.93
6100	0.299	34.48	4.05	-101.50	0.169	-102.40	0.351	28.31
6200	0.305	29.74	3.99	-105.60	0.170	-105.20	0.363	24.74
6300	0.309	24.69	3.93	-109.70	0.171	-108.30	0.372	21.23
6400	0.315	19.38	3.87	-113.80	0.173	-111.30	0.384	17.59
6500	0.321	14.29	3.81	-118.00	0.173	-114.30	0.397	14.21
6600	0.328	9.17	3.75	-122.20	0.174	-117.30	0.409	10.60
6700	0.336	4.38	3.68	-126.30	0.175	-120.30	0.423	6.96
6800	0.341	-0.47	3.62	-130.60	0.175	-123.30	0.436	3.49
6900	0.347	-5.56	3.56	-134.80	0.176	-126.50	0.448	-0.11
7000	0.354	-11.02	3.50	-139.10	0.176	-129.80	0.460	-3.70
7100	0.362	-16.35	3.43	-143.30	0.176	-133.00	0.473	-7.35
7200	0.370	-21.28	3.36	-147.60	0.176	-136.10	0.487	-11.17
7300	0.375	-26.33	3.30	-151.80	0.176	-139.30	0.498	-14.77
7400	0.382	-31.44	3.23	-156.10	0.176	-142.50	0.509	-18.53
7500	0.388	-36.79	3.17	-160.50	0.175	-145.80	0.522	-22.11
7600	0.396	-42.26	3.10	-164.80	0.174	-149.10	0.533	-25.90
7700	0.404	-47.28	3.03	-169.10	0.173	-152.30	0.545	-29.70
7800	0.411	-52.16	2.96	-173.30	0.172	-155.50	0.556	-33.43
7900	0.415	-57.01	2.89	-177.80	0.170	-158.70	0.567	-37.06
8000	0.420	-62.26	2.82	-177.80	0.169	-161.90	0.576	-40.62
8100	0.428	-67.55	2.74	-173.50	0.167	-165.30	0.585	-44.37
8200	0.434	-72.42	2.66	-169.20	0.165	-168.50	0.597	-48.16
8300	0.440	-77.09	2.59	-165.00	0.163	-171.60	0.607	-51.70
8400	0.444	-81.65	2.52	-160.80	0.161	-174.80	0.613	-55.32
8500	0.447	-86.47	2.44	-156.60	0.159	-177.90	0.620	-58.85
8600	0.449	-91.53	2.37	-152.20	0.156	-178.90	0.627	-62.36
8700	0.454	-96.36	2.30	-148.10	0.153	-175.80	0.633	-65.95
8800	0.458	-100.70	2.22	-143.90	0.150	-172.90	0.639	-69.52
8900	0.458	-105.00	2.15	-139.80	0.147	-170.00	0.643	-72.86
9000	0.457	-109.60	2.08	-135.70	0.145	-166.90	0.646	-76.16
9100	0.457	-114.40	2.01	-131.60	0.142	-164.10	0.648	-79.55
9200	0.458	-119.20	1.94	-127.40	0.139	-161.10	0.651	-82.91
9300	0.458	-123.50	1.87	-123.40	0.135	-158.20	0.653	-86.32
9400	0.458	-127.60	1.81	-119.40	0.132	-155.50	0.655	-89.66
9500	0.455	-131.80	1.74	-115.40	0.129	-152.80	0.653	-92.83
9600	0.450	-136.40	1.67	-111.40	0.125	-150.20	0.653	-96.02
9700	0.449	-140.90	1.61	-107.50	0.122	-147.60	0.652	-99.21
9800	0.449	-145.00	1.54	-103.80	0.119	-145.20	0.651	-102.30
9900	0.447	-148.70	1.48	-100.00	0.115	-142.70	0.649	-105.50
10000	0.441	-152.50	1.42	-96.35	0.112	-140.80	0.647	-108.50

S-Parameter Data Files are available online at: www.mimixbroadband.com

Mimix Broadband, Inc., 10795 Rockley Rd., Houston, Texas 77099
Tel: 281.988.4600 Fax: 281.988.4615 mimixbroadband.com

Page 5 of 7

Characteristic Data and Specifications are subject to change without notice. ©2006 Mimix Broadband, Inc.
Export of this item may require appropriate export licensing from the U.S. Government. In purchasing these parts, U.S. Domestic customers accept their obligation to be compliant with U.S. Export Laws.

www.BDTIC.com/MACOM

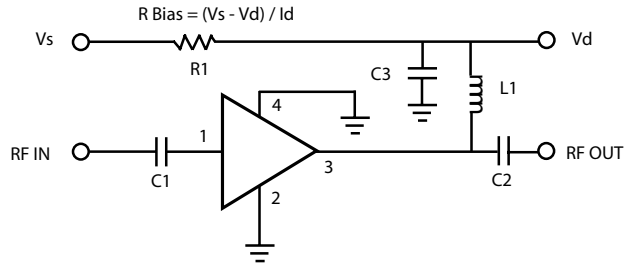
DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier

Application Circuit

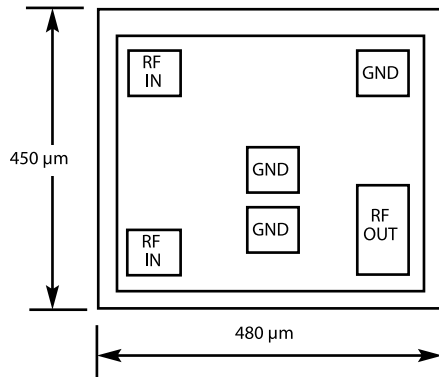
Note: This schematic represents the topology of the application circuit recommended by Mimix.

Recommended Bias Resistor Values for $I_D = 63 \text{ mA}$				
Supply Voltage (V_s)	7V	8V	10V	12V
Rbias (1/4W)	31 Ω	47 Ω	—	—
Rbias (1/2W)	—	—	78 Ω	110 Ω

Note: Rbias provides DC bias stability over temperature.



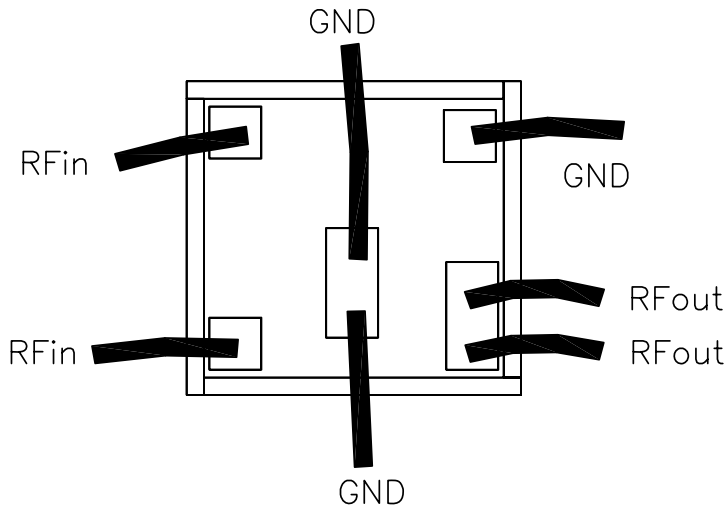
Physical Dimensions



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

Ref Designator	Value
C1, C2	1000 pF
C3	1.0 μF
L1	56 nH
R 1	$R_{\text{Bias}} = (V_s - V_d) / I_d$

Bonding Configuration



Caution: ESD Sensitive
Appropriate precautions in handling, packaging
and testing devices must be observed.

DC-6.0 GHz InGaP HBT MMIC Matched Gain Block Amplifier



April 2007 - Rev 03-Apr-07

CGB7008-BD
XRoHS

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. 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 Tanaka TS3332LD, Die Mat DM6030HK or DM6030HK-Pt 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. For additional information please see the Mimix "Epoxy Specifications for Bare Die" application note.

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 Gold 0.025 mm (0.001") diameter ball bonds. 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.

Part Number for Ordering	Description
CGB7008-BD-000V	RoHS compliant die packed in vacuum release gel paks