Advanced Product Information
June 2004 V1.0 *(1 of 6)*

0.1 GHz to 6.0 GHz InGaP HBT, MMIC or Packaged, Matched Gain Block Amplifier

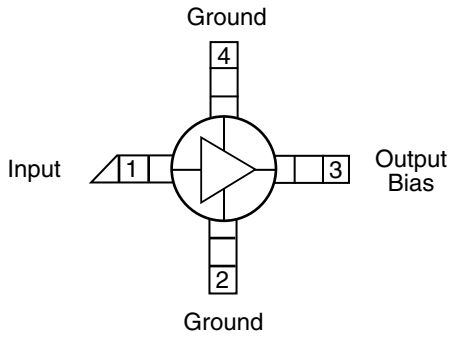
Features

- ❑ **35.5 dBm Output IP3** @ 850 MHz
- ❑ **3.5 dB Noise Figure** @ 850 MHz
- ❑ **20.7 dB Gain** @ 850 MHz
- ❑ **19.8 dBm P1dB** @ 850 MHz
- ❑ **Low Performance Variation Over Temperature**
- ❑ **Low Cost: Die Form or SOT-86 Package**
- ❑ **100% DC On-Wafer Testing**
- ❑ **ESD Protection on All Die: >1000V HBM**
- ❑ **Low Thermal Resistance: <110°C/Watt**

Applications

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

Functional Block Diagram (SOT-86)



Description

The CGB7010-SP (-BD) is a **Darlington Configure**d, high dynamic range, utility gain block amplifier. Designed for applications operating within the 0.1 GHz to 6.0 GHz frequency range, Celeritek'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-86 package. The CGB7010-SP (-BD) is fabricated in **Celeritek's in-house foundry**. Celeritek'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 Celeritek test fixture.

		850 MHz			1950 MHz			2400 MHz			3500 MHz			
Parameter	**Temperature (°C)**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Units**
Small Signal Gain	+25 -40 to +85	19.7 19.4	20.7 20.7	21.7 22.0	16.2 15.9	17.2 17.2	18.2 18.5	14.9 14.6	15.9 15.9	16.9 17.2		13.9 13.9		dB dB
Output P1dB	+25 -40 to +85	18.8 18.5	19.8 19.8		18.1 17.8	19.1 19.1		17.1 16.8	18.1 18.1			15.5 15.5		dBm dBm
Output IP3	+25 -40 to +85	34.0 33.5	35.5 35.5		32.5 31.5	34.0 34.0		31.0 30.0	32.5 32.5			28.7 28.7		dBm dBm
Noise Figure	+25 -40 to +85		3.5 3.5	4.3 4.7		3.5 3.5	4.3 4.5		3.5 3.5	4.3 4.7		3.7 3.7		dB dB
Operating Current	+25 -40 to +85	71 77	75 86	90 95	82 77	86 86	90 95	82 77	86 86	90 95		86 86		mA mA
Input Return Loss	+25 -40 to +85	17 16	24 24		11 10	17 17		11 10	15 15			19 19		dB dB
Output Return Loss	+25 -40 to +85	15 14	24 22		13 12	20 20		12 11	18 18			23 23		dB dB
Pout @ -45 dBc ACP, IS-95, 9 Forward Channels	+25 -40 to +85		14.0 14.0			14.0 14.0								dBm dBm

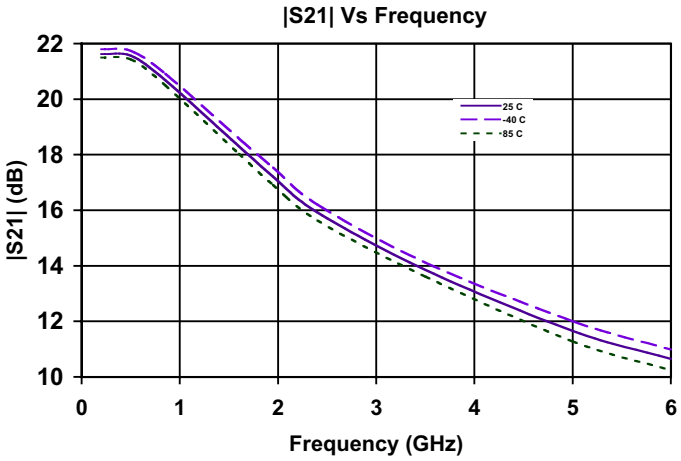
Notes: 1. Test Conditions in Celeritek eval board, Vs = 8 V, Id = 75 mA Typ., Rbias = 39 Ω, Zs = Zl = 50Ω, OIP3 tone spacing = 1 MHz, Pout per tone = 6 dBm.
2. Values reflect performance in recommended application circuit.

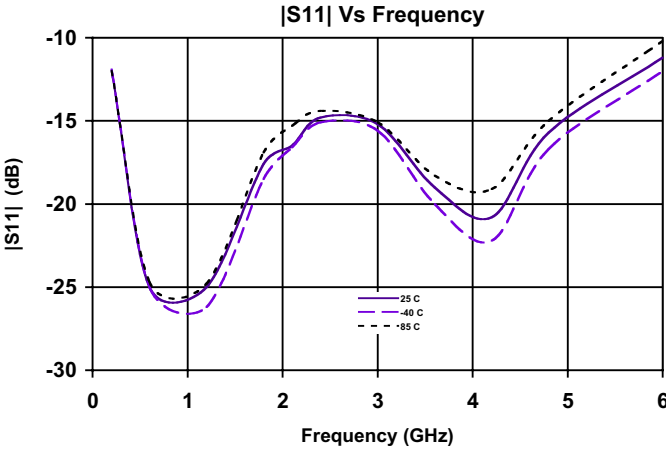
Absolute Maximum Ratings

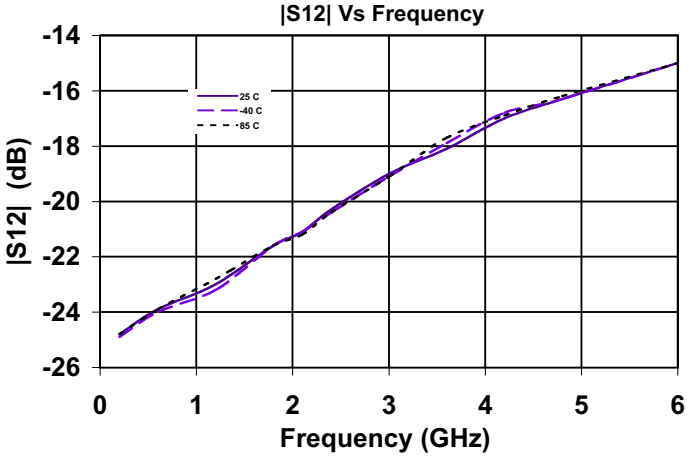
Operation of this device above any of these parameters may cause damage.

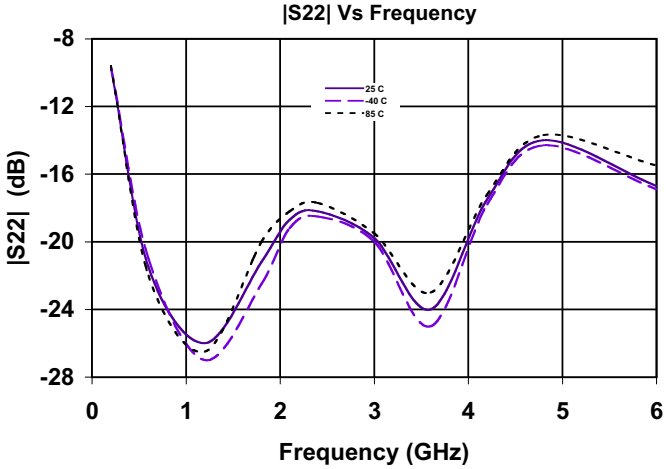
Parameter	Rating	Parameter	Rating	Parameter	Rating
Max Device Voltage	+6.0 V	RF Input Power	+17 dBm	Operating Temperature	-40°C to +85°C
Max Device Current	130 mA	Storage Temperature	-55°C to +150°C	Thermal Resistance	110°C/W
Max Device Dissipated Pwr	0.65 W	Junction Temperature	150°C	ESD (HBM)	1000 V

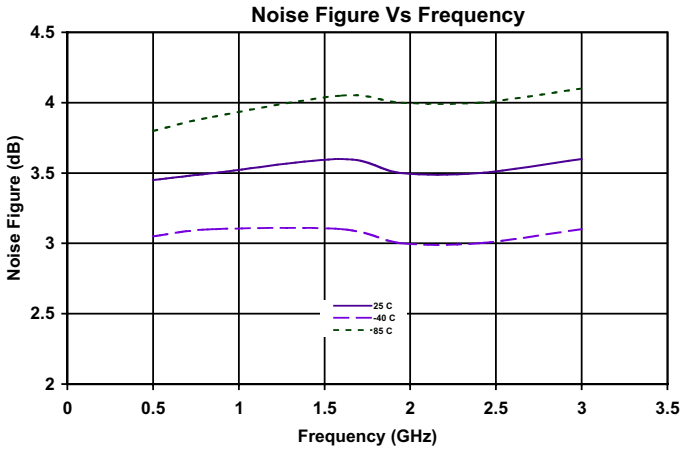
Typical S-Parameter and Noise Performance



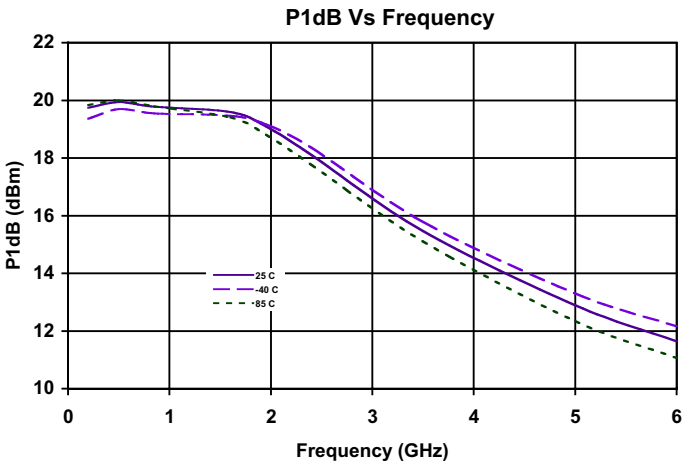


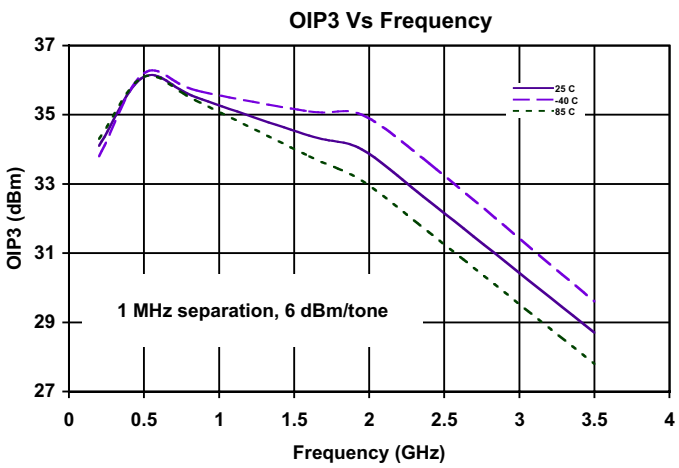




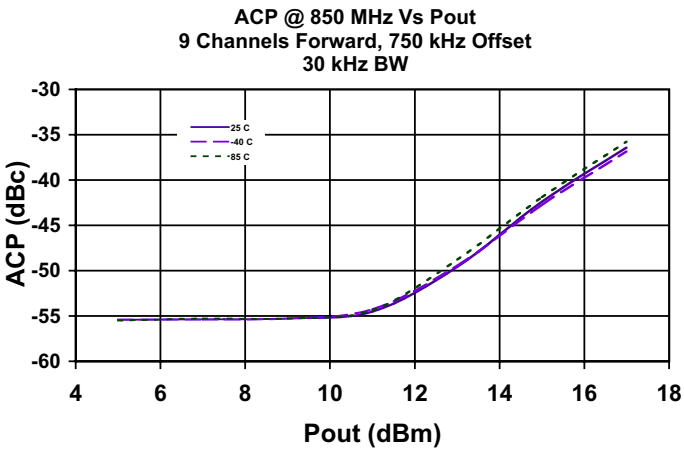


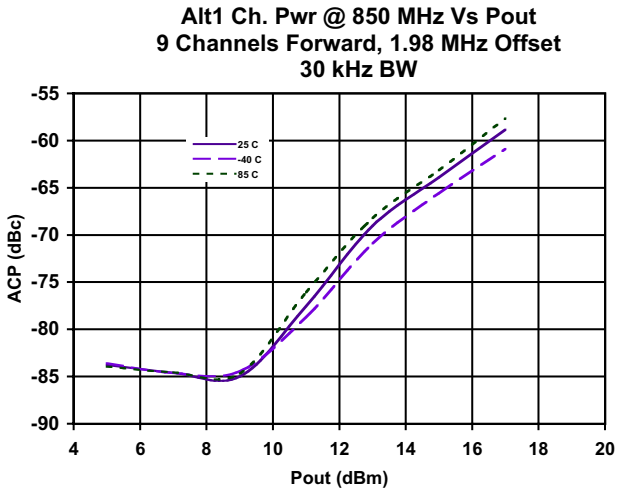
Typical Power and Linearity Performance

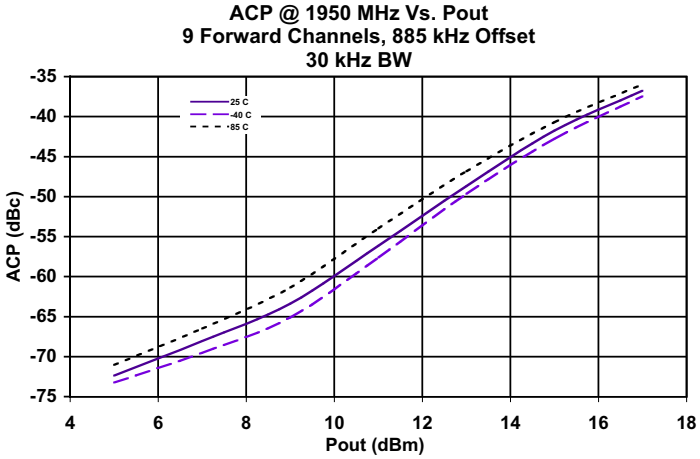


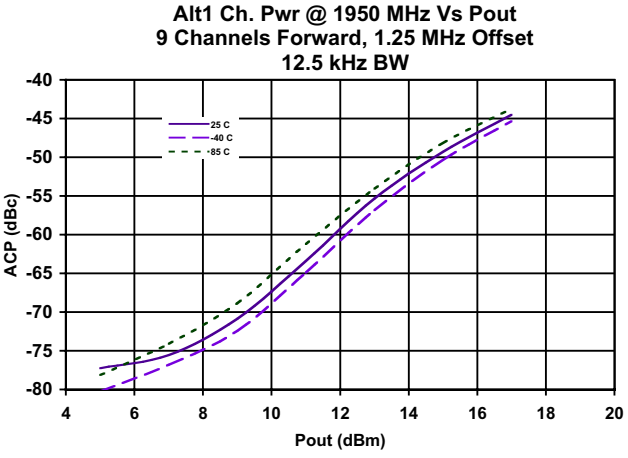


Linearity Performance - Base Station ACP – IS-95









Typical Scattering Parameters – CGB-7010-SP (Vd = +5.06V, Icc = 73 mA, T = 23°C, device in a 50 ohm system)

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(MHz)	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)	(Mag)	(Ang)
100	0.034	163	13.3	173	0.063	1	0.049	-9
200	0.034	147	13.1	166	0.063	2	0.050	-16
300	0.035	129	12.9	159	0.064	3	0.052	-23
400	0.036	113	12.7	153	0.065	4	0.052	-30
500	0.036	98	12.4	146	0.065	5	0.053	-38
600	0.038	82	12.1	140	0.066	6	0.054	-44
700	0.040	69	11.7	134	0.067	7	0.054	-50
800	0.042	53	11.4	128	0.069	7	0.056	-56
900	0.044	42	11.0	123	0.070	8	0.057	-62
1000	0.046	29	10.6	118	0.071	8	0.059	-68
1200	0.053	9	9.9	107	0.075	9	0.060	-78
1400	0.062	-10	9.2	98	0.078	9	0.064	-86
1600	0.069	-26	8.6	89	0.082	9	0.067	-94
1800	0.077	-39	8.1	80	0.087	8	0.071	-101
2000	0.084	-52	7.6	72	0.091	7	0.074	-109
2200	0.093	-62	7.1	64	0.096	6	0.077	-115
2400	0.101	-73	6.7	57	0.101	5	0.081	-121
2600	0.108	-82	6.3	50	0.106	3	0.084	-126
2800	0.115	-91	6.0	43	0.111	1	0.088	-131
3000	0.122	-99	5.7	37	0.116	-1	0.093	-137
3200	0.130	-107	5.4	30	0.121	-3	0.097	-142
3400	0.137	-115	5.2	24	0.126	-6	0.103	-147
3600	0.143	-123	5.0	17	0.132	-8	0.107	-154
3800	0.149	-130	4.8	11	0.137	-11	0.112	-159
4000	0.155	-137	4.6	5	0.142	-14	0.118	-165
4200	0.160	-145	4.5	-1	0.148	-16	0.122	-171
4400	0.165	-152	4.3	-7	0.153	-19	0.128	-177
4600	0.169	-160	4.2	-13	0.158	-22	0.135	176
4800	0.174	-167	4.1	-19	0.164	-25	0.140	170
5000	0.178	-175	4.0	-25	0.170	-28	0.149	163
5200	0.182	178	3.9	-31	0.175	-32	0.155	156
5400	0.187	170	3.8	-37	0.181	-35	0.163	150
5600	0.190	163	3.7	-43	0.186	-38	0.171	143
5800	0.197	155	3.6	-49	0.192	-42	0.182	136
6000	0.200	147	3.6	-55	0.197	-45	0.191	129
6500	0.214	126	3.4	-70	0.211	-54	0.224	111
7000	0.233	104	3.3	-85	0.226	-64	0.269	92
7500	0.256	82	3.2	-101	0.239	-74	0.320	75
8000	0.285	60	3.1	-117	0.252	-84	0.380	57
8500	0.320	38	3.0	-135	0.262	-95	0.451	39
9000	0.357	18	2.9	-152	0.268	-107	0.523	22
9500	0.391	-2	2.7	-170	0.271	-119	0.602	6
10000	0.417	-20	2.5	171	0.268	-131	0.672	-11

S-Parameter Data Files are available on-line at: www.celeritek.com

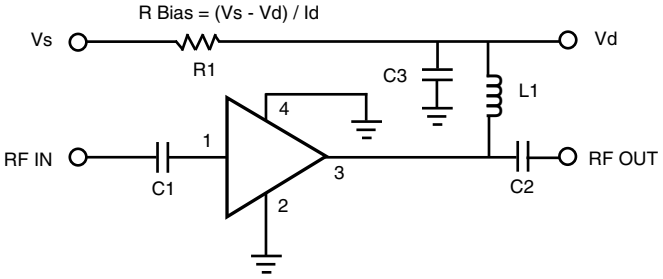
3236 Scott Boulevard, Santa Clara, California 95054
Phone: (408) 986-5060 *Fax: (408) 986-5095*

Application Circuit

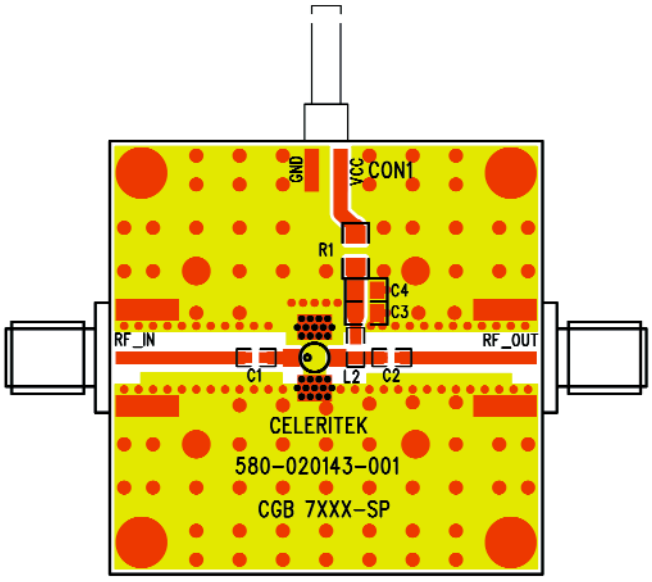
Note: This schematic represents the topology of the application circuit recommended by Celeritek.

Recommended Bias Resistor Values for ID = 75 mA				
Supply Voltage (V)	7V	8V	10V	12V
Rbias (R1 Description: 1206 1/4W 1%)	25Ω	39Ω	—	—
Rbias (R1 Description: 1210 1/2W 1%)	—	—	65Ω	92Ω

Note: Rbias provides DC bias stability over temperature.

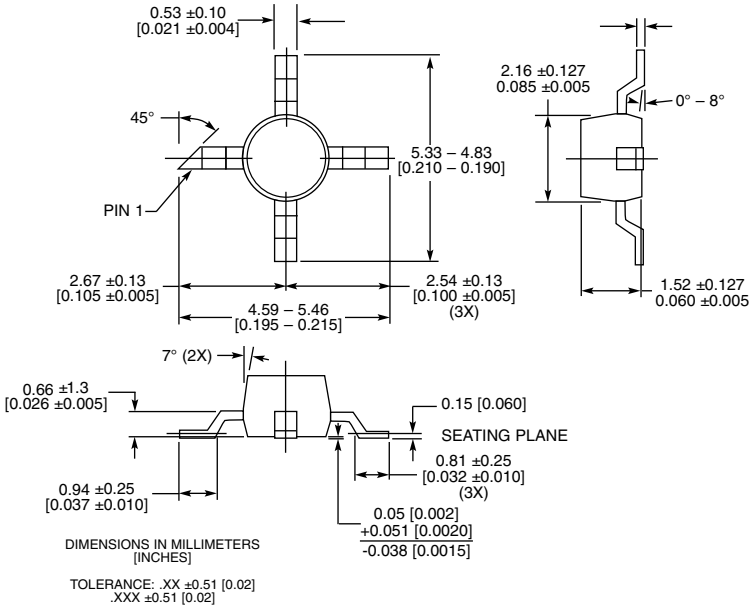


Evaluation Board SP Package (SOT-86)

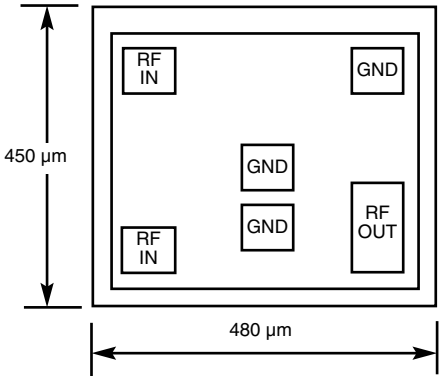


Ref Designator	Value	Description	Size
C1, C2	1000 pF	MCH185A101JK	0805
C3	1.0 µF	VITR 1.0 µF 25V CER CAP 0805 X7R 10%	0805
L1	56 nH	Coilcraft 0603 CS 10%	0603
R1		R Bias = (Vs - Vd) / Id	1206 / 1210
C4		DNP (Do Not Place)	N/A

Physical Dimensions - SP Package (SOT-86)



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.

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

Ordering Information

The CGB7000 family of cascadable gain block amplifiers are available in bare die form or in a SOT-86 package

Part Number for Ordering	Package
CGB7010-BD	**Bare die in GelPak**
CGB7010-SP	**SOT-86 Surface mount package in tube or tape and reel**
PB-CGB7010-SP	**Evaluation Board with SMA connectors for CGB7010-SP**

For your local distributor: Richardson Electronics-Worldwide, Phone: 1-800-737-6937 or www.rfwireless.rell.com