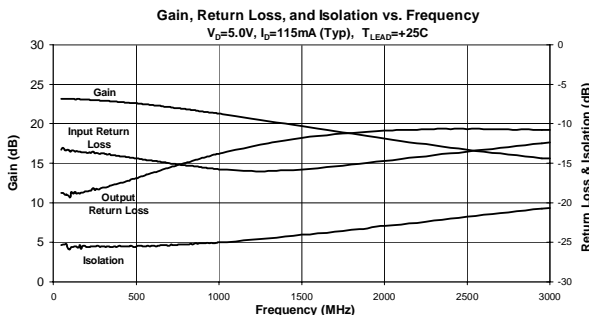




## Product Description

Sirenza Microdevices' SGA-7489 is a high performance SiGe heterojunction bipolar transistor MMIC amplifier. A Darlington configuration featuring 1 micron emitters provides high  $F_T$  and excellent thermal performance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products.

Basic circuit operation is achieved with just a single supply voltage, DC blocking and bypass capacitors, a bias resistor, and a bias inductor. Simple capacitive tuning may be used to extend high OIP3 performance to 2GHz.



## SGA-7489

### DC-3000 MHz Silicon Germanium HBT Cascadeable Gain Block



### Product Features

- DC-3000 MHz Operation
- Very High IF Output IP3: 39dBm at 100MHz
- High Output IP3: +35.5 dBm typ. at 850 MHz
- Low Noise Figure: 3.3 dB typ. at 1950 MHz

### Applications

- Oscillator Amplifiers
- PA for Low / Medium Power Applications
- IF/ RF Buffer Amplifier
- Drivers for CATV Amplifiers
- LO Driver Amplifier

Symbol	Parameter	Freq. (MHz)	Min.	Typ.	Max.	Units
$P_{1dB}$	Output Power at 1dB Compression	850 1950	18.5	22.4 20.0		dBm
$OIP_3$	Output Third Order Intercept Point * Using 2 GHz App. Ckt. (see page 5)	100 850 1950 1950 *	31.0	39.0 35.5 33.0 36.0 *		dBm
$S_{21}$	Small Signal Gain	850 1950	20.0 17.0	21.5 18.5	23.0 20.0	dB
Bandwidth	Determined by Return Loss (>9dB)			3000		MHz
IRL	Input Return Loss	1950	10.3	15.0		dB
ORL	Output Return Loss	1950	9.0	11.0		dB
$S_{12}$	Reverse Isolation	1950		23.0		dB
NF	Noise Figure, $Z_s = 50$ Ohms	1950		3.3	4.3	dB
$V_D$	Device Operating Voltage		4.7	5.0	5.3	V
$I_D$	Device Operating Current		103	115	127	mA
$R_{TH}$ , j-I	Thermal Resistance (junction - lead)			82		$^{\circ}C/W$

**Test Conditions:**  $V_S = 8V$   $I_D = 115mA$  Typ.  
 Bias Resistance = 26 Ohms

$OIP_3$  Tone Spacing = 1 MHz, Pout per tone = 0 dBm  
 $T_L = 25^{\circ}C$   $Z_S = Z_L = 50$  Ohms

**NOTE:** The recommended operating current in the preliminary datasheet was 130mA. Supplemental measurements have since shown that an operating current of 115mA results in optimal RF performance over temperature. Continued operation at 130mA is reliable, however, the recommended operating current has been changed to 115mA.

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### Typical RF Performance at Key Operating Frequencies

Symbol	Parameter	Unit	Frequency (MHz)				
			100	500	850	1950	2400
G	Small Signal Gain	dB	23.0	22.5	21.5	18.5	17.0
OIP <sub>3</sub>	Output Third Order Intercept Point	dBm	39.0	36.5	35.5	33.0 *	32.2
P <sub>1dB</sub>	Output Power at 1dB Compression	dBm	22.8	22.6	22.4	20.0	19.0
IRL	Input Return Loss	dB	13.5	14.5	15.5	15.0	13.5
ORL	Output Return Loss	dB	19.5	17.0	14.5	11.0	10.5
S <sub>12</sub>	Reverse Isolation	dB	26.0	25.5	25.0	23.0	22.0
NF	Noise Figure	dB	2.7	2.7	2.8	3.3	

**Test Conditions:**  $V_S = 8\text{ V}$   $I_D = 115\text{ mA}$  Typ.  $OIP_3$  Tone Spacing = 1 MHz, Pout per tone = 0 dBm  
Bias Resistance = 26 Ohms  $T_L = 25^\circ\text{C}$   $Z_S = Z_L = 50\text{ Ohms}$

\* NOTE: An OIP3 of +36dBm at 1950 MHz is achieved using the tuned circuit shown on page 5.

### Absolute Maximum Ratings

Parameter	Absolute Limit
Max. Device Current ( $I_D$ )	170 mA
Max. Device Voltage ( $V_D$ )	7 V
Max. RF Input Power : $Z_L = 50\text{ Ohms}$	+16 dBm
Max. RF Input Power : Load VSWR=10:1*	+2 dBm
Max. Junction Temp. ( $T_J$ )	+150°C
Operating Temp. Range ( $T_O$ )	-40°C to +85°C
Max. Storage Temp.	+150°C

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage must not exceed 5.3V and the device current must not exceed 143mA.

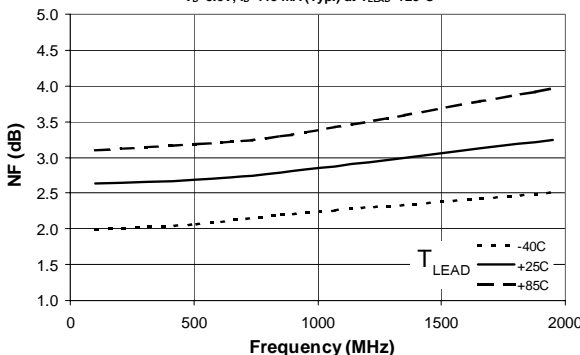
Bias Conditions should also satisfy the following expression:

$$I_D V_D < (T_J - T_O) / R_{TH} \text{ J-1}$$

\*Note: Take into account out of band load VSWR presented by devices such as SAW filters to determine maximum RF input power. Reflected harmonic levels in saturation are significant.

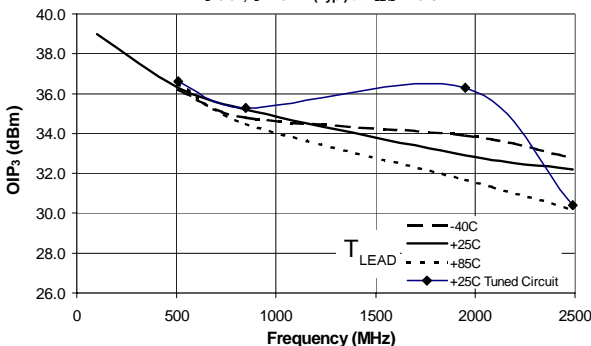
**Noise Figure vs. Frequency over Temperature**

$V_D=5.0\text{V}$ ,  $I_D=115\text{ mA}$  (Typ.) at  $T_{LEAD}=+25^\circ\text{C}$



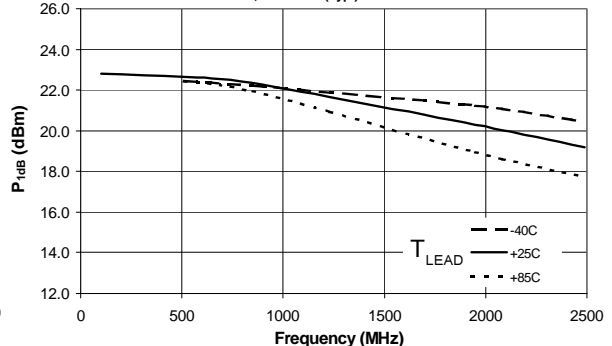
**OIP<sub>3</sub> vs. Frequency over Temperature**

$V_D=5.0\text{V}$ ,  $I_D=115\text{ mA}$  (Typ.) at  $T_{LEAD}=+25^\circ\text{C}$

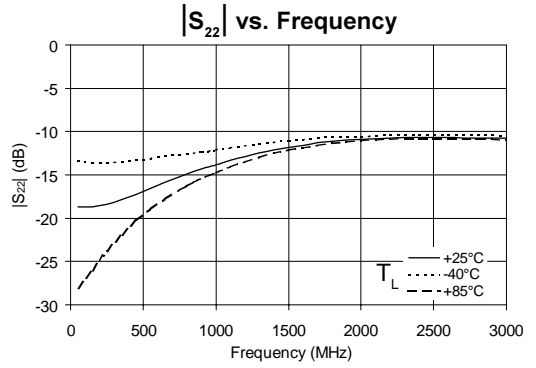
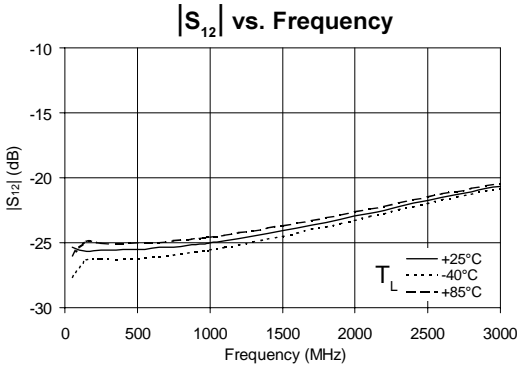
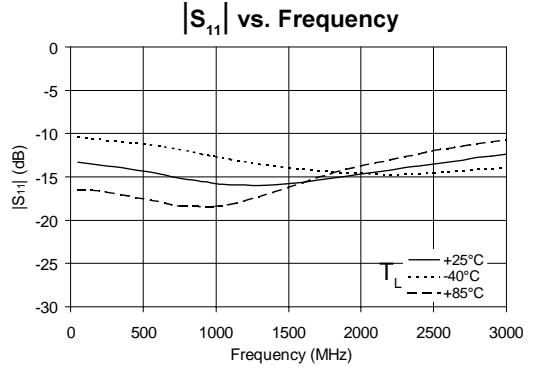
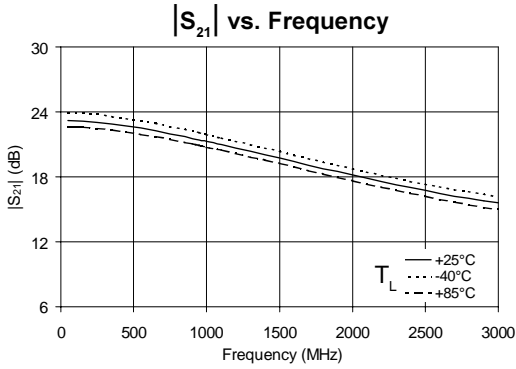


**P<sub>1dB</sub> vs. Frequency over Temperature**

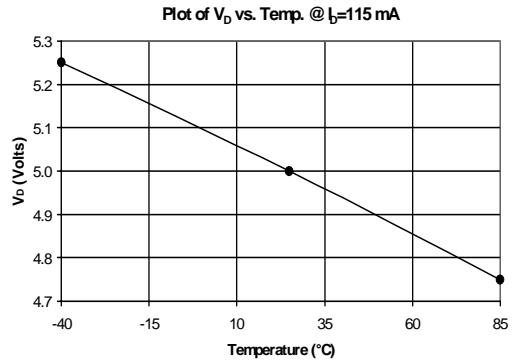
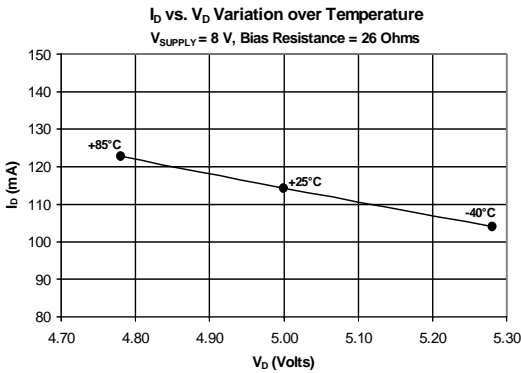
$V_D=5.0\text{V}$ ,  $I_D=115\text{ mA}$  (Typ.) at  $T_{LEAD}=+25^\circ\text{C}$



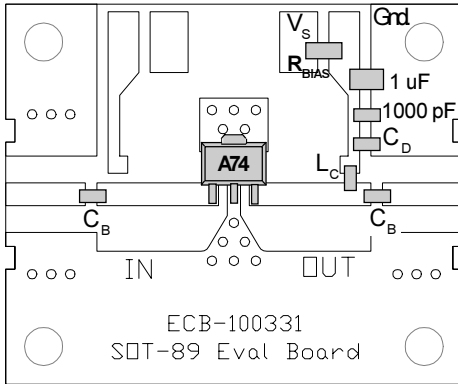
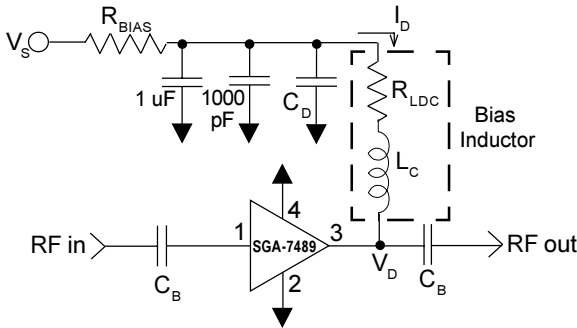
**Typical RF Performance Over Temperature** (Bias:  $V_s = 8.0$  V, Bias Resistance=26 Ohms,  $I_D = 115$  mA)



NOTE: Full S-parameter data available at [www.sirenza.com](http://www.sirenza.com)

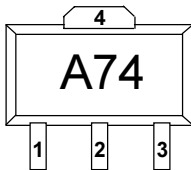


**Basic Application Circuit**



**Part Identification Marking**

The part will be marked with an "A74" designator on the top surface of the package.



**Caution: ESD sensitive**

Appropriate precautions in handling, packaging and testing devices must be observed.

**Application Circuit Element Values**

Reference Designator	Frequency (MHz)				
	100	500	850	1950	2400
C <sub>B</sub>	1000 pF	220 pF	100 pF	68 pF	56 pF
C <sub>D</sub>	100 pF	100 pF	68 pF	22 pF	22 pF
L <sub>C</sub>	470 nH	68 nH	33 nH	22 nH	18 nH

**Required Bias Resistance for I<sub>D</sub>=115mA**  
**Bias Resistance = R<sub>BIAS</sub> + R<sub>LDC</sub> = (V<sub>S</sub>-V<sub>D</sub>) / I<sub>D</sub>**

Supply Voltage(V <sub>S</sub> )	7 V	8 V	9 V	12 V
Bias Resistance	17 Ω	26 Ω	35 Ω	61 Ω

Bias resistor improves current stability over temperature.

**Mounting Instructions**

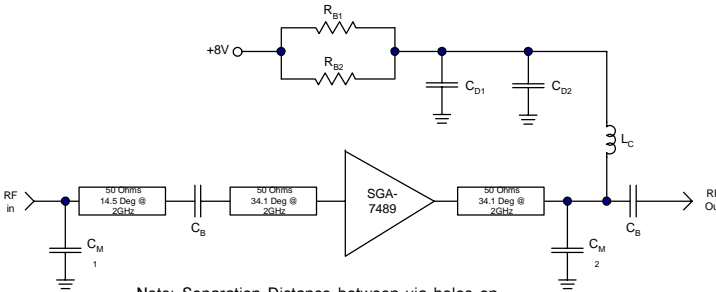
1. Solder the copper pad on the backside of the device package to the ground plane.
2. Use a large ground pad area with many plated through-holes as shown.
3. We recommend 1 or 2 ounce copper. Measurement for this data sheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.

Pin #	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
2, 4	GND	Connection to ground. For optimum RF performance, use via holes as close to ground leads as possible to reduce lead inductance.
3	RF OUT/BIAS	RF output and bias pin. DC voltage is present on this pin, therefore a DC blocking capacitor is necessary for proper operation.

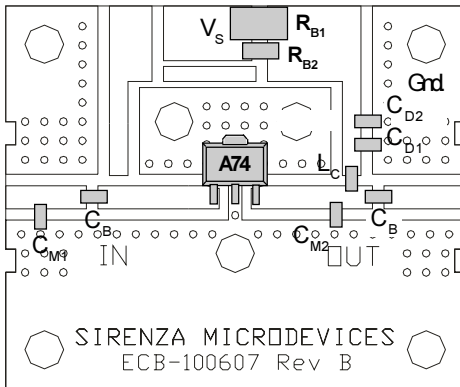
**Part Number Ordering Information**

Part Number	Reel Size	Devices/Reel
SGA-7489	13"	3000

## 2GHz Application Circuit

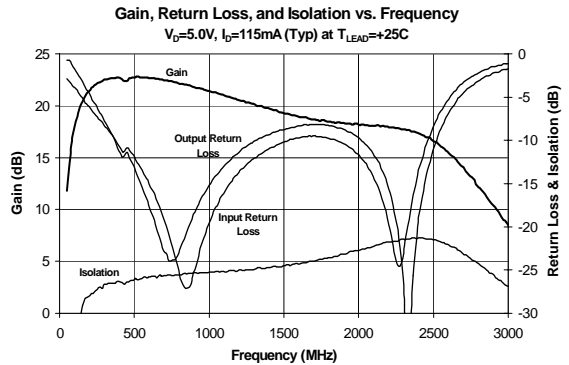


Note: Separation Distance between via holes on board represents approx. 5.4 Degrees phase shift @ 2GHz for equivalent distance on microstrip.  
Board material is GETEK,  $\epsilon = 4.1$



### 2 GHz Application Circuit Component Values

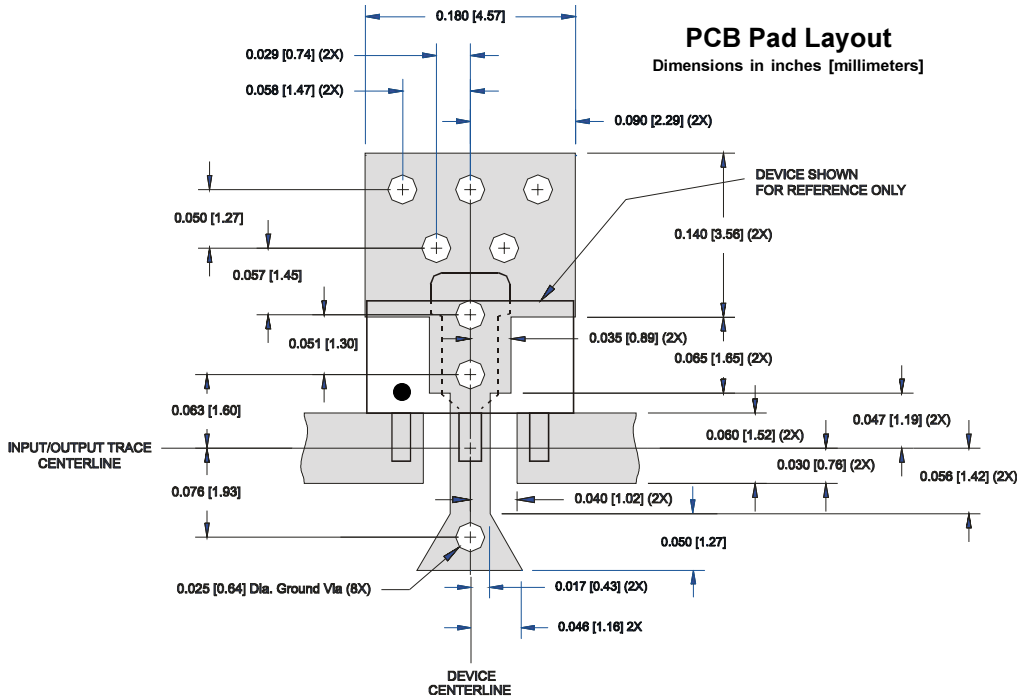
Reference Designator	Value	Manuf.	P/N
C <sub>D1</sub> , C <sub>B</sub>	100 pF	ROHM	MCH185A101JK
C <sub>M1</sub>	1.2 pF	ROHM	MCH185A1R2JK
C <sub>M2</sub>	1.5 pF	ROHM	MCH185A1R5JK
C <sub>O2</sub>	0.1 uF	ROHM	MCH182FN1042K
L <sub>C</sub>	22 nH	TOKO	LL1608FS22NJ
R <sub>B1</sub>	27 Ohms, 1/2 W	ROHM	Type MRC 50
R <sub>B2</sub>	610 Ohm 1/4 W	ROHM	Type MRC 18



### Typical RF Performance in Tuned 2GHz Application Circuit

Symbol	Parameter	Unit	Frequency (MHz)		
			1700	1950	2100
G	Small Signal Gain	dB	18.6	18.3	18.2
OIP <sub>3</sub>	Output Third Order Intercept Point	dBm	36.1	36.0	34.5
P <sub>1dB</sub>	Output Power at 1dB Compression	dBm	20.8	20.4	19.9
IRL	Input Return Loss	dB	10	11.2	16.3
S <sub>12</sub>	Reverse Isolation	dB	23.8	23.0	22.1
NF	Noise Figure	dB	3.1	3.3	3.7

**Test Conditions:** V<sub>S</sub> = 8 V, I<sub>b</sub> = 115 mA Typ., OIP<sub>3</sub> Tone Spacing = 1 MHz, P<sub>out</sub> per tone = 0 dBm  
Bias Resistance = 26 Ohms, T<sub>L</sub> = 25°C, Z<sub>S</sub> = Z<sub>L</sub> = 50 Ohms



### Nominal Package Dimensions

Dimensions in inches [millimeters]

Refer to package drawing posted at [www.sirenza.com](http://www.sirenza.com) for tolerances.

