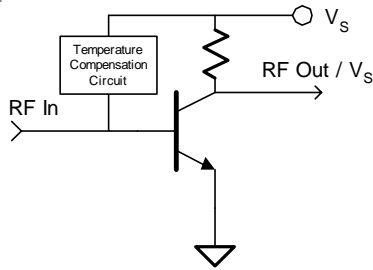




## Product Description

The SGL-0163 is a high performance SiGe HBT MMIC low noise amplifier featuring 1 micron emitters with  $F_T$  up to 50 GHz. This device has an internal temperature compensation circuit permitting operation directly from supply voltages as low as 2.5 V. The SGL-0163 has been characterized at  $V_d = 3$  V for low power and 4 V for medium power applications. Only 2 DC-blocking capacitors, a bias resistor, and an optional RF choke are required for operation from 800-1300 MHz. The useful range of the SGL-0163 may be extended down to 100 MHz using simple lumped element tuning.

The matte tin finish on Sirenza's lead-free "Z" package is applied using a post annealing process to mitigate tin whisker formation and is RoHS compliant per EU Directive 2002/95. The package body is manufactured with green molding compounds that contain no antimony trioxide or halogenated fire retardants.



## SGL-0163

**SGL-0163Z** RoHS Compliant & Green Package

## 100 - 1300 MHz Silicon Germanium Cascadable Low Noise Amplifier



### Product Features

- Available in Lead Free, RoHS Compliant green package ( Z Suffix )
- Internally Matched to 50 Ohms 800-1300 MHz
- High Input / Output Intercept
- Low Noise Figure: 1.2dB typ. at 900 MHz
- Low Power Consumption
- Single Voltage Supply Operation
- Internal Temperature Compensation

### Applications

- Receivers, GPS, RFID
- Cellular, Fixed Wireless, Land Mobile

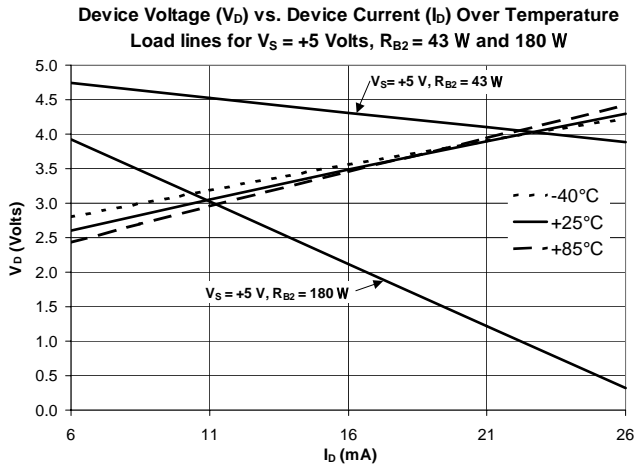
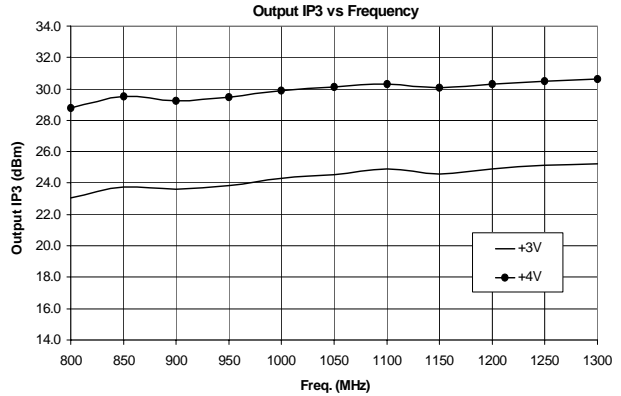
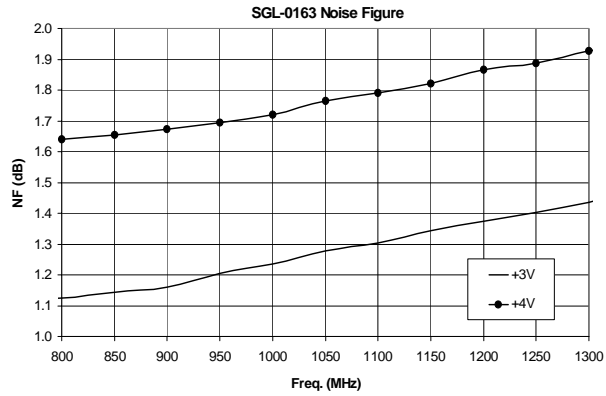
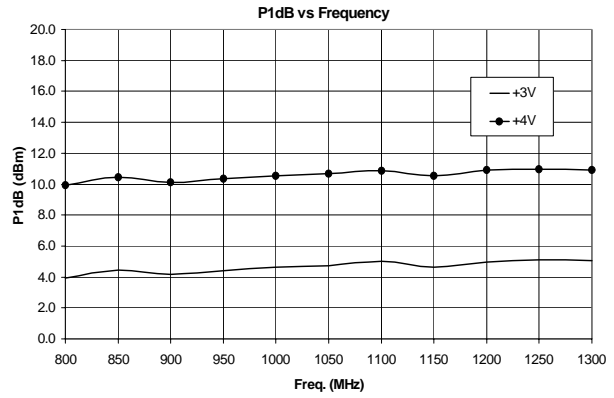
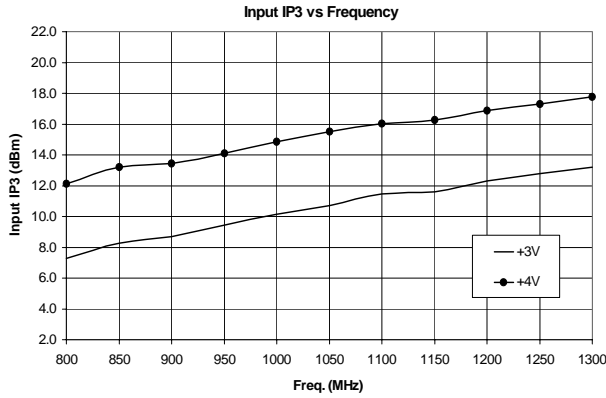
Symbol	Parameter	Freq. (MHz)	Min. ( $V_s=3V$ )	Typ. ( $V_s=3V$ )	Max. ( $V_s=3V$ )	Typ. ( $V_s=4V$ )	Units
G	Small Signal Gain	800 900 1000	14.0	15.7 15.5 14.1	17.0	16.6 15.8 15.0	dB
$P_{1dB}$	Output Power at 1dB Compression	800 900 1000	3.2	4.4 5.2 5.6		9.9 10.1 10.5	dBm
$IIP_3$	Input Third Order Intercept Point Tone Spacing = 1 MHz Pout per tone = -13dBm	800 900 1000	5.0	5.3 7.0 9.0		12.1 13.4 14.8	dBm
NF	Noise Figure, $Z_s = 50$ Ohms	800 900 1000		1.1 1.2 1.2	1.7	1.6 1.7 1.7	dB
IRL	Input Return Loss	900	10.0	12.5		15.7	dB
ORL	Output Return Loss	900	11.5	15.6		17.6	dB
$S_{12}$	Reverse Isolation	900		20.9		20.9	dB
$I_b$	Device Current		9.5	12.0	14.0	23	mA
$R_{TH,j-l}$	Thermal Resistance (junction to lead)			255			$^{\circ}C/W$
<b>Test Conditions: 800-1300 MHz Application Circuit <math>T_{LEAD} = 25^{\circ}C</math> <math>Z_0 = Z_L = 50</math> Ohms</b>							

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**SGL-0163(Z) 100-1300 MHz SiGe Low Noise Amplifier**

Typical RF Performance at  $V_S = 3\text{ V}$  and  $4\text{ V}$  -- 800-1300 MHz Evaluation Board --  $T_{LEAD} = +25^\circ\text{C}$



**Absolute Maximum Ratings**

Parameter	Absolute Limit
Max. Device Current ( $I_D$ )	45 mA
Max. Device Voltage ( $V_S$ )	5 V
Max. RF Input Power	+10 dBm
Max. Junction Temp. ( $T_J$ )	+150°C
Operating Temp. Range ( $T_{LEAD}$ )	-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 and current must not exceed the maximum operating values specified in the table on page one.

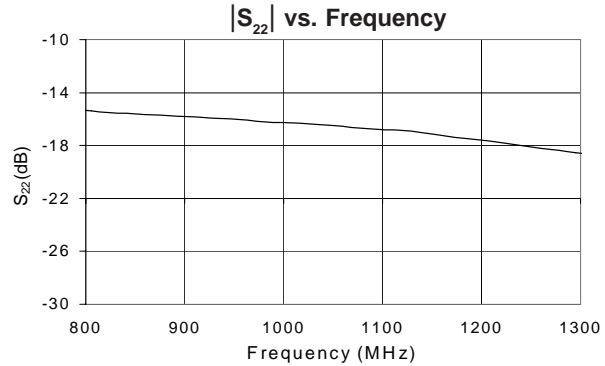
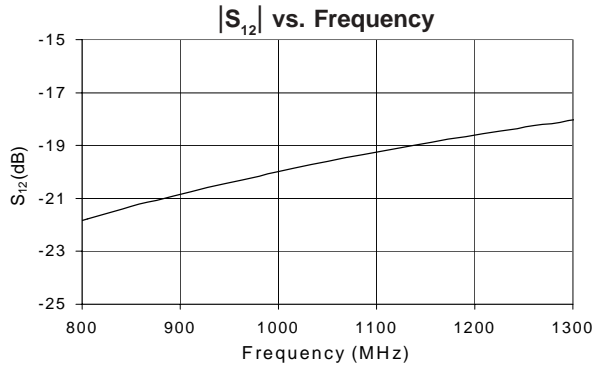
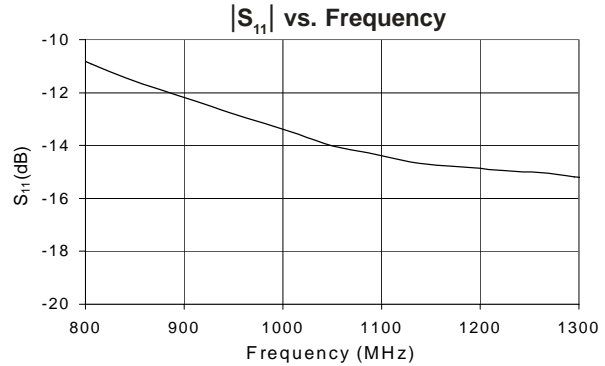
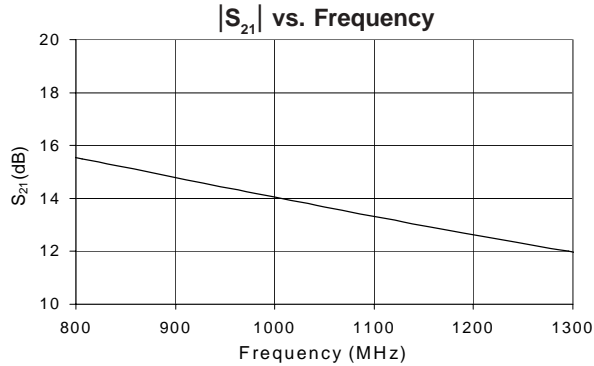
Bias conditions should also satisfy the following expression:

$$I_D V_D < (T_J - T_{LEAD}) / R_{TH} \text{ } ^\circ\text{C/W}$$

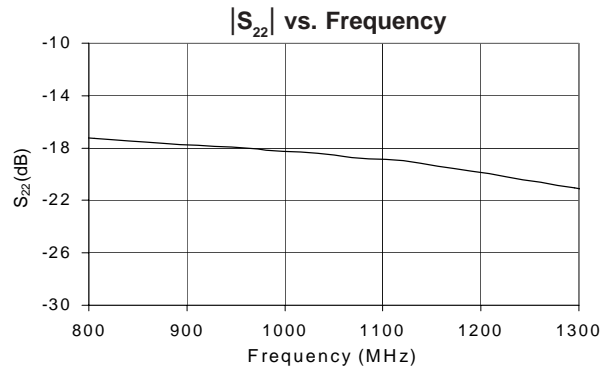
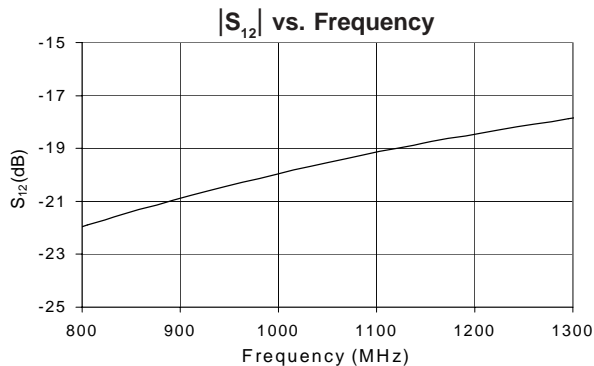
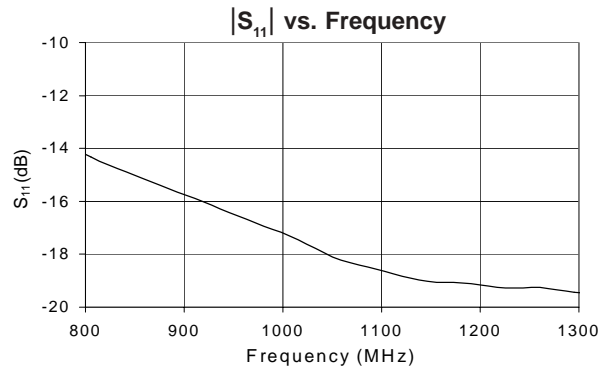
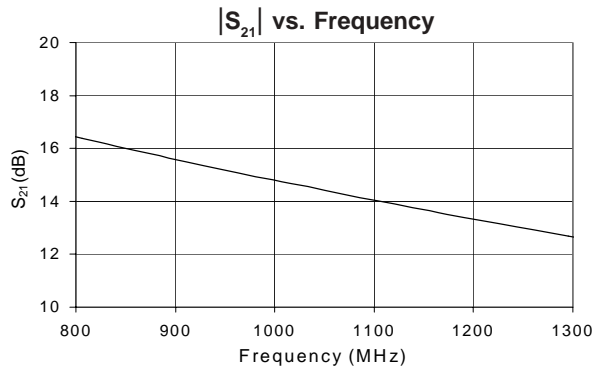


**SGL-0163(Z) 100-1300 MHz SiGe Low Noise Amplifier**

Typical RF Performance at  $V_s = 3\text{ V}$  -- 800-1300 MHz Evaluation Board --  $T_{LEAD} = +25^\circ\text{C}$



Typical RF Performance at  $V_s = 4\text{ V}$  -- 800-1300 MHz Evaluation Board --  $T_{LEAD} = +25^\circ\text{C}$



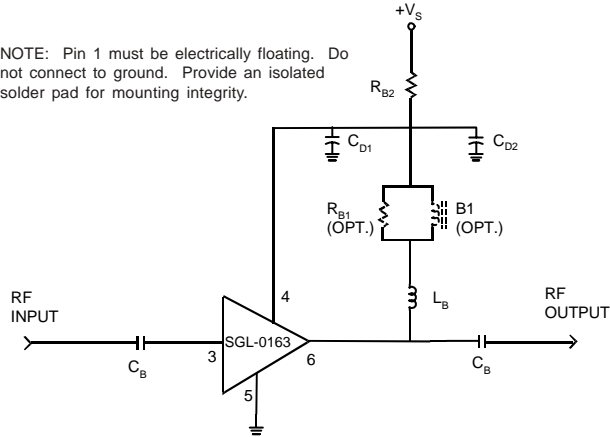
NOTE: Full S-parameter data available at [www.sirenza.com](http://www.sirenza.com)



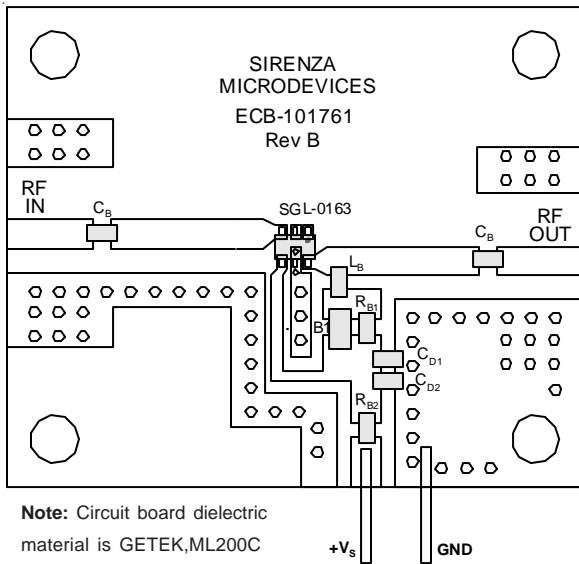
**SGL-0163(Z) 100-1300 MHz SiGe Low Noise Amplifier**

**800-1300 MHz Application Circuit**

NOTE: Pin 1 must be electrically floating. Do not connect to ground. Provide an isolated solder pad for mounting integrity.



**800-1300 MHz Evaluation Circuit Board**



Note: Circuit board dielectric material is GETEK, ML200C

**Application Circuit Element Values**

Reference Designator	Value	Manufacturer & Part No.
$L_B$	33 nH	TOKO LL1608-FS27NJ
B1 <sup>1</sup>	1500 Ohms @100 MHz	FAIR-RITE 2508051527y0 Ferrite Bead
$C_B, C_{D1}$	0.1 uF	SAMSUNG CL10B103KBNC
$C_{D2}$	22 pF	ROHM MCH185AA220DJK
$R_{B1}$ <sup>1</sup>	47 Ohms	PHILLIPS 9C06031A47R0 JL HFT
$R_{B2}$ <sup>2</sup>	0 Ohms	PHILLIPS 9C06031A0R00 JL HFT

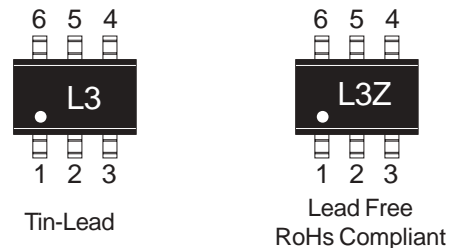
Notes:

- B1 and  $R_{B1}$  provide improved K-factor but are optional.
- $R_{B2}$  may be introduced as a voltage dropping resistor for use with supply voltages greater than the desired device bias voltage.

**Device Pin Out Guide**

Pin #	Function	Description
1	N/C	No electrical connection. Provide an isolated (un-grounded) solder pad for mounting integrity.
3	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
4	DC BIAS	Voltage supply connection. Bypass with suitable capacitors.
2, 5	Ground	Connection to ground. Provide via holes as close to the device ground leads as possible to reduce ground inductance and achieve optimum RF performance.
6	RF OUT/BIAS	RF output and voltage supply. DC voltage is present on this pin, therefore a DC blocking capacitor is necessary for proper operation.

**Part Identification Marking & Pin Out**



Reliability & Qualification Information	
Parameter	Rating
ESD Rating - Human Body Model (HBM)	Class 1A
Moisture Sensitivity Level	MSL 1

The product qualification report may be downloaded at [www.sirenza.com](http://www.sirenza.com)



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

**Part Ordering Information**

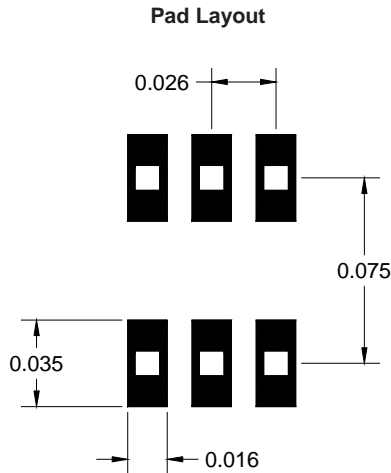
Part Number	Package / Lead Composition	Reel Size	Devices / Reel
SGL-0163	Tin-Lead	7"	3000
SGL-0163Z	Lead Free, RoHS Compliant	7"	3000



**SGL-0163(Z) 100-1300 MHz SiGe Low Noise Amplifier**

**SOT-363 PCB Pad Layout**

Dimensions in inches [millimeters]



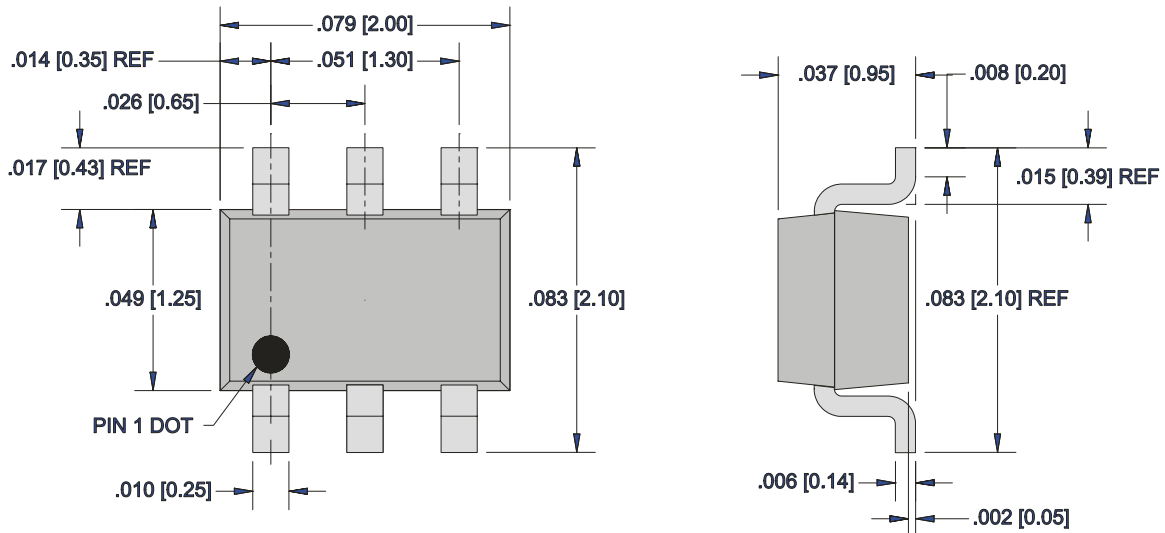
Notes:

1. Provide a ground pad area under device pins 2 & 5 with plated via holes to the PCB ground plane.
2. We recommend 1 or 2 ounce copper. Measurements for this data sheet were made on a 31 mil thick Getek with 1 ounce copper on both sides.

**SOT-363 Nominal Package Dimensions**

Dimensions in inches [millimeters]

A link to the SOT-363 package outline drawing with full dimensions and tolerances may be found on the product web page at [www.sirenza.com](http://www.sirenza.com).





**SGL-0163(Z) 100-1300 MHz SiGe Low Noise Amplifier**

**100-800 MHz Operation**

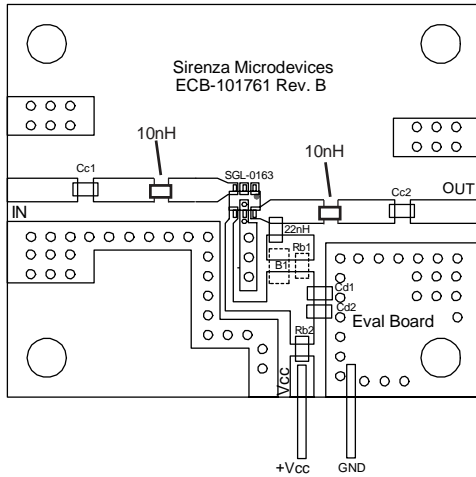
The useful range of the SGL-0163 may be extended down to 100MHz using simple lumped element tuning. Following are two examples.

- Option 1.** A series inductor introduced at the input and output optimizes RF performance over 100MHz wide bands. Band center is selected by adjustment of the inductor values. The example presented is optimized for the 400-500 MHz band.
- Option 2.** An RC feedback network provides broadband RF performance from 100-800MHz. The resistor value may be adjusted to select a combination of gain/NF/return loss best suited to the particular application.

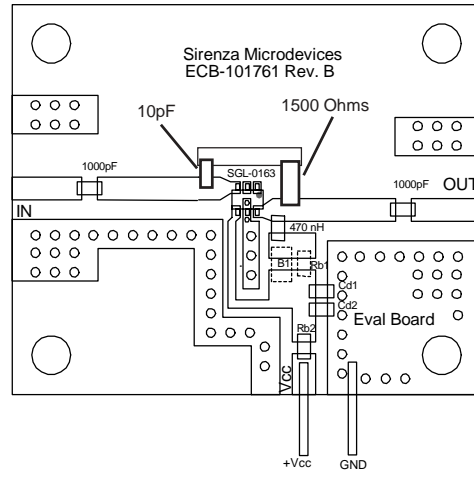
Data and schematics for these two options are presented below and on the following pages.

Contact Sirenza amplifier applications for further guidance.

**Option 1. Series L Tune**



**Option 2. RC Feedback Tune**



**Application Circuit Parts List**

Ref. Designator	Description	Value	Manufact. Part No.
B1 <sup>2</sup>	Ferrite Bead	1500 Ohms @100 MHz	FAIR-RITE 2508051527y0
Cc1,Cc2,Cd1	Capacitor,SM,0603	0.1 uF	SAMSUNG CL10B103KBNC T/R
Cd2	Capacitor,SM,0603	22 pF	ROHM MCH185AA220DJK
Rb1 <sup>2</sup>	Resistor,SM,0603	47 Ohms	PHILLIPS 9C06031A47R0 JL HFT
Rb2	Resistor,SM,0603	0 Ohms	PHILLIPS 9C06031A0R00 JL HFT
N/A <sup>1</sup>	Circuit Board	N/A	Sirenza Microdevices ECB101761 Rev B

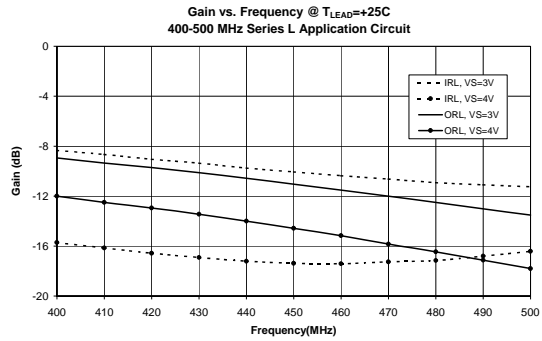
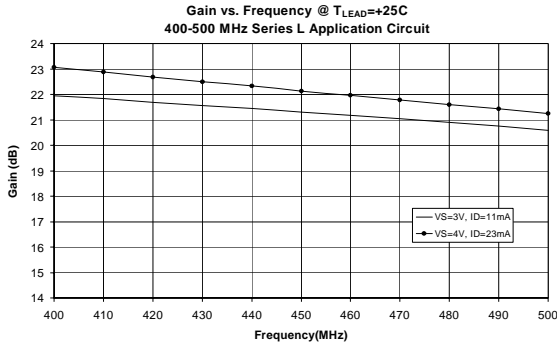
**Notes:**

- (1) Circuit board dielectric material is GETEK,ML200C
- (2) B1 and Rb1 recommended for improved K-factor but are optional. Replace with 0 Ohm resistor if not used.



**SGL-0163(Z) 100-1300 MHz SiGe Low Noise Amplifier**

**RF Performance - 400-500MHz Series L Application Circuit**

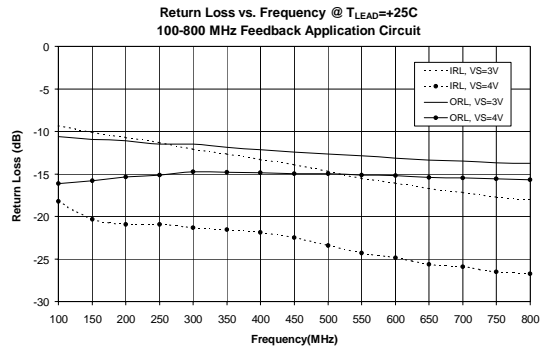
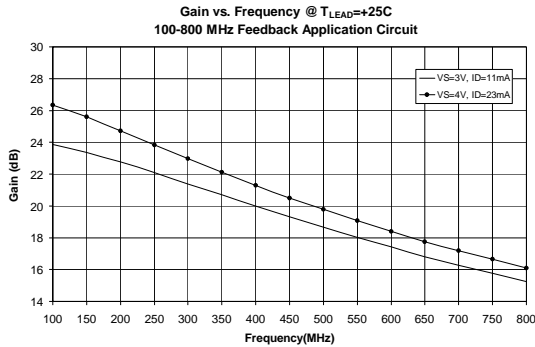


VS=3V, ID=11mA (Typ.)					
Freq	Gain (dB)	P1dB (dBm)	IIP3 (dBm)	OIP3 (dBm)	NF (dB)
400 MHz	22.0	4.4	1.3	23.1	1.1
450 MHz	21.3	5.0	3.2	24.7	1.3
500 MHz	20.6	5.7	4.1	24.7	1.3

VS=4V, ID=24mA (Typ.)					
Freq	Gain (dB)	P1dB (dBm)	IIP3 (dBm)	OIP3 (dBm)	NF (dB)
400 MHz	23.1	10.9	6.5	29.6	2.0
450 MHz	22.2	11.4	8.1	30.3	2.1
500 MHz	21.2	12.0	7.8	28.9	2.1

**RF Performance - 100-800 MHz RC Feedback Application Circuit**



VS=3V, ID=11mA (Typ.)					
Freq	Gain (dB)	P1dB (dBm)	IIP3 (dBm)	OIP3 (dBm)	NF (dB)
100 MHz	23.9	3.5	-6.8	17.1	1.4
300 MHz	21.4	3.4	-2.5	18.9	1.2
500 MHz	18.7	3.5	0.1	18.8	1.2
800 MHz	15.2	3.7	4.3	19.5	1.2

VS=4V, ID=23mA (Typ.)					
Freq	Gain (dB)	P1dB (dBm)	IIP3 (dBm)	OIP3 (dBm)	NF (dB)
100 MHz	26.3	9.2	-4.1	22.2	2.2
300 MHz	23.0	9.8	2.2	25.1	1.9
500 MHz	19.8	9.9	5.2	25.0	1.7
800 MHz	16.1	10.0	9.7	25.8	1.7

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