



# DC to 5000 MHz, SILICON GERMANIUM CASCADABLE GAIN BLOCK

Package: SOT-363

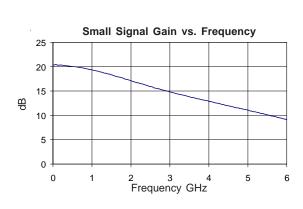




#### **Product Description**

The SGA0363Z is a high performance SiGe HBT MMIC Amplifier. A Darlington configuration featuring one-micron emitters provides high  $F_T$  and excellent thermal perfomance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. Only two DC-blocking capacitors, a bias resistor and an optional RF choke are required for operation.





#### **Features**

- DC to 5000MHz Operation
- Single Voltage Supply
- Low Current Draw: 11mA at 2.5 V Typ.
- High Output Intercept: 14dBm Typ. at 1950MHz

#### **Applications**

- PA Driver Amplifier
- Cellular, PCS, GSM, UMTS
- IF Amplifier
- Wireless Data, Satellite

Parameter	Specification			Unit	Condition	
Farameter	Min.	Тур.	Max.	UIIIL	Condition	
Output Power at 1dB Compression		2.3		dBm	850MHz	
		2.3		dBm	1950MHz	
		1.6		dBm	2400 MHz	
Third Order Intercept Point		14.2		dBm	850MHz	
		14.0		dBm	1950MHz	
		13.1		dBm	2400 MHz	
Small Signal Gain		19.6		dB	850MHz	
		17.2		dB	1950MHz	
		16.2		dB	2400 MHz	
3dB Bandwidth		5000		MHz		
Input VSWR		1.8:1			DC to 4500 MHz	
Output VSWR		1.7:1			DC to 4500 MHz	
Reverse Isolation		24.0		dB	850MHz	
		22.8		dB	1950MHz	
		22.1		dB	2400 MHz	
Noise Figure <sup>[1]</sup>		3.0		dB	1950MHz	
Device Operating Voltage		2.5		V		
Device Operating Current	9	11	13	mA		
Thermal Resistance		255		°C/W	junction - lead	

 $\text{Test Conditions: V}_S = \text{5V, I}_D = \text{11mA Typ., T}_L = 25 \,^{\circ}\text{C. OIP3 Tone Spacing} = \text{1MHz, P}_{\text{OUT}} \text{ per tone} = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 50 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = Z_L = 20 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \, \text{dBm, R}_{\text{BIAS}} = 220 \, \Omega, Z_S = 22 \, \Omega = -12 \,$ 

# **SGA0363Z**



#### **Absolute Maximum Ratings**

Parameter	Rating	Unit
Device Current (I <sub>D</sub> )	22	mA
Device Voltage (V <sub>D</sub> )	6	V
RF Input Power	-5	dBm
Junction Temp (T <sub>J</sub> )	+150	°C
Operating Temp Range (T <sub>L</sub> )	-40 to +85	°C
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:  $I_DV_D\!<\!(T_J\!-\!T_L)/R_{TH},j\!-\!I$ 



#### Caution! ESD sensitive device.

CAUGHT LOD SCHARLIVE DEVICE.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

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RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in

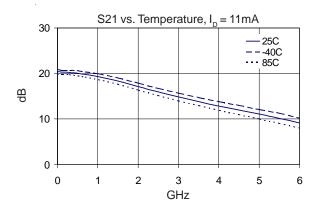
Min.   Ypb.   Max.	Davamatav		Specification		Heit	Oan dikian		
20.0   dB   500MHz     19.6   dB   850MHz     17.2   dB   1950MHz     16.2   dB   2400MHz     13.8   dB   3500MHz     14.8   dBm   100MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     14.5   dBm   850MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     14.2   dBm   850MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     13.1   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     15.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     12.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=12 dBm     12.0   dBm   100MHz     12.0   dBm   100MHz     12.0   dBm   100MHz     12.0   dBm   1950MHz     12.0   dBm   100MHz     12.0	Parameter	Min.	Тур.	Max.	Unit	Condition		
19.6	Gain				dB	100 MHz		
17.2   dB   3950MHz     16.2   dB   2400MHz     13.8   dB   3500MHz     14.8   dB   100MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     14.5   dBm   500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     14.0   dBm   550MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     15.1   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     15.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     10.5   dBm   100MHz     10.5   dBm   100MHz     10.8   dBm   100MHz     10.8   dBm   3500MHz     10.8   dBm   2400MHz     10.8   dBm   3500MHz     10			20.0		dB	500MHz		
16.2   dB   2400MHz     13.8   dB   3500MHz     14.8   dBm   3500MHz     14.9   dBm   100MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   12.dBm     14.2   dBm   850MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   14.2dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   14.2dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   13.1   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   12.dBm     11.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12.dBm   100MHz     12.3   dBm   500MHz     13.1   dBm   2400MHz     14.0   dBm   3500MHz     15.0   dBm   3500MHz     16.0   dBm   3500MHz     17.0   dBm   3500MHz     18.0   dBm   3500MHz     19.4   dBm   3500MHz     19.4   dBm   3500MHz     19.4   dBm   3500MHz     19.5 MHz			19.6		dB	850MHz		
13.8			17.2		dB	1950MHz		
Dutput IP3								
14.5   dBm   500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   850MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   850MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   100MHz   11.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   100MHz   12 dBm			13.8		dB			
14.2   dBm   850MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     13.1   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     11.5   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     11.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     12.0   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 12dBm     12.0   dBm   500MHz     2.0   dBm   500MHz     2.0   dBm   850MHz     2.0   dBm   3500MHz     1.6   dBm   2400MHz     1.6   dBm   2400MHz     1.6   dBm   3500MHz     1.6	Output IP <sub>3</sub>		14.8		dBm			
14.0   dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   1950MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   11.5   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=   12 dBm   100MHz   12 d			14.5		dBm	500 MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= -12dBm		
13.1   dBm   2400MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 1.2dBm     11.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 1.2dBm     11.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= 1.2dBm     10.0			14.2		dBm	850 MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= -12dBm		
11.5   dBm   3500MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone=			14.0		dBm			
Output P1dB   3.2   dBm   100MHz			13.1		dBm	2400 MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= -12dBm		
2.9			11.5		dBm	3500 MHz, Tone spacing=1MHz, P <sub>OUT</sub> per tone= -12 dBm		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Output P1dB		3.2		dBm	100MHz		
2.3   dBm   1950MHz     1.6   dBm   2400MHz     0.8   dBm   3500MHz     100MHz     100MHz     100MHz     100MHz     10.4   dB   1950MHz     10.5   4   dB   1950MHz     10.8   dB   2400MHz     11.3   dB   3500MHz     11.3   dB   3500MHz     11.3   dB   3500MHz     12.3   dB   100MHz     12.3   dB   100MHz     12.3   dB   500MHz     13.5   dB   500MHz     14.6   dB   1950MHz     15.6   dB   1950MHz     16.7   dB   1950MHz     17.8   dB   1950MHz     18.8   dB   100MHz     18.8   dB   100MHz     18.8   dB   100MHz     18.8   dB   3500MHz     18.8   dB   3500MHz     18.8   dB   3500MHz     18.8   dB   3500MHz     18.8   dB   500MHz   25   50Ω     18.8   dB   2400MHz   25   50Ω     18.8   dB   2400MHz   25   25   25     18.8   dB   2400MHz   25   25   25     18.8   dB   2400MHz   25   25   25   25     18.8   dB   2400M			2.9		dBm	500MHz		
1.6			2.3		dBm	850MHz		
0.8			2.3		dBm	1950MHz		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			1.6		dBm	2400MHz		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			0.8		dBm	3500MHz		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Input Return Loss		9.3		dB	100 MHz		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			9.4		dB	500MHz		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			9.4		dB	850MHz		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			10.4		dB	1950MHz		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			10.8		dB	2400 MHz		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			11.3		dB	3500MHz		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Reverse Isolation		23.9		dB	100MHz		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			23.9		dB	500MHz		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			24.0		dB	850MHz		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			22.8		dB	1950MHz		
Noise Figure         2.9         dB         100 MHz, $Z_S = 50 Ω$ 2.8         dB         500 MHz, $Z_S = 50 Ω$ 3.0         dB         850 MHz, $Z_S = 50 Ω$			22.1		dB	2400 MHz		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			20.1		dB	3500MHz		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Noise Figure		2.9		dB	100 MHz, $Z_S = 50 \Omega$		
$3.0$ dB $850$ MHz, $Z_S$ = $50\Omega$			2.8		dB			
			3.0		dB	-		
			3.0		dB	1950MHz, Z <sub>S</sub> =50Ω		

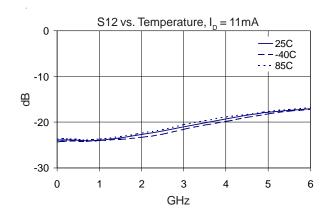
Test Conditions: I<sub>D</sub>=8mA, unless otherwise noted

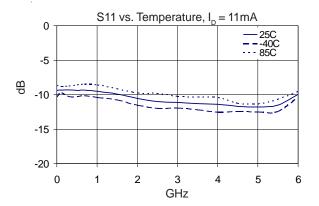


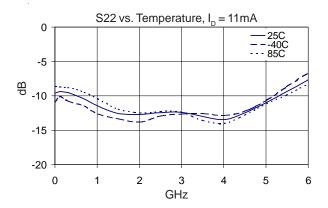


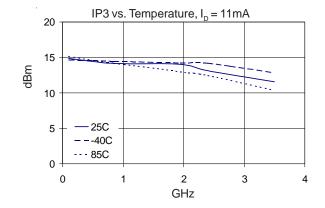


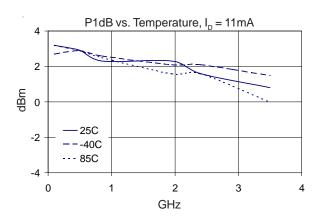








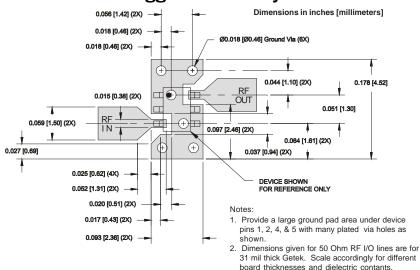






Pin	Function	Description
3	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
1, 2, 4, 5	GND	Connection to ground. Use via holes for best performance to reduce lead inductance as close to ground leads as possible.
6	RF OUT/BIAS	RF output and bias pin. DC voltage is present on this pin, therefore a DC blocking capacitor is necessary for proper operation.

### **Suggested Pad Layout**

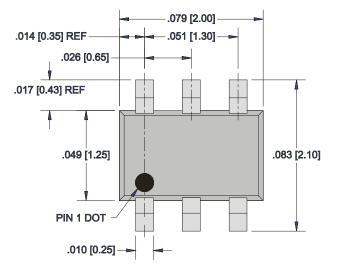


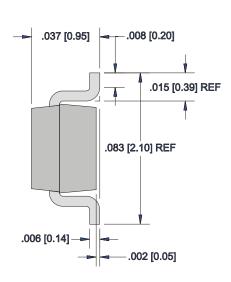
- board thicknesses and dielectric contants.

  3. We recommend 1 or 2 ounce copper. Measure-
- ments for this data sheet were made on a 31 mil thick Getek with 1 ounce copper on both sides.

## **Package Drawing**

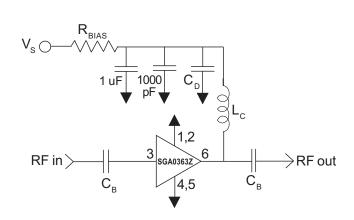
Dimensions in inches (millimeters) Refer to drawing posted at www.rfmd.com for tolerances.







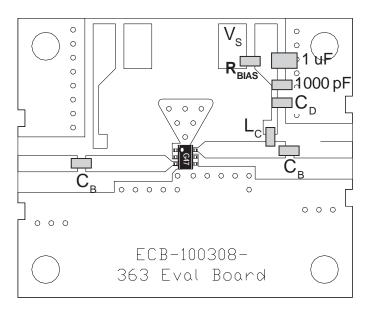
## **Application Schematic**



Reference		Frequency (Mhz)						
Designator	500	850	1950	2400	3500			
C <sub>B</sub>	220 pF	100 pF	68 pF	56 pF	39 pF			
C <sub>D</sub>	100 pF	68 pF	22 pF	22 pF	15 pF			
L <sub>c</sub>	68 nH	33 nH	22 nH	18 nH	15 nH			

Recommended Bias Resistor Values for $I_D$ =11mA $R_{BIAS}$ =( $V_S$ - $V_D$ ) / $I_D$				
Supply Voltage(V <sub>s</sub> )	5 V	7.5 V	9 V	12 V
$R_{BIAS}$ 220 $\Omega$ 470 $\Omega$ 620 $\Omega$ 910 $\Omega$				
Note: R <sub>RIAS</sub> provides DC bias stability over temperature.				

## **Evaluation Board Layout**

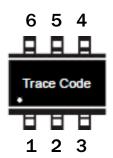


#### **Mounting Instructions**

- 1. Use a large ground pad area near device pins 1, 2, 4, and 5 with many plated through-holes as shown.
- We recommend 1 or 2 ounce copper. Measurements for this data sheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.



# **Part Identification Marking**



# **Ordering Information**

Ordering Code	Description
SGA0363Z	7" Reel with 3000 pieces
SGA0363ZSQ	Sample bag with 25 pieces
SGA0363ZSR	7" Reel with 100 pieces
SGA0363Z-EVB1	850MHz, 5V Operation PCBA