SCA-4

DC-4 GHz, Cascadable GaAs HBT MMIC Amplifier

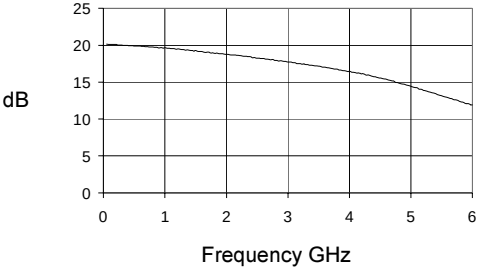
NGA-589 Recommended for New Designs

Product Description

Sirenza Microdevices' SCA-4 is a high performance Gallium Arsenide Heterojunction Bipolar Transistor MMIC Amplifier. A Darlington configuration is utilized for broadband performance up to 4 GHz. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. Typical IP3 at 850 MHz with 65mA is 33.2 dBm.

These unconditionally stable amplifiers provide 20 dB of gain and 17.7 dBm of 1dB compressed power and require only a single positive voltage supply. Only 2 DC-blocking capacitors, a bias resistor and an optional inductor are needed for operation.

Small Signal Gain vs. Frequency @ I_D=65mA



Product Features

- **High Output IP3: 33.2 dBm @ 850 MHz**
- **Cascadable 50 Ohm Gain Block**
- **Patented GaAs HBT Technology**
- **Operates From Single Supply**

Applications

- **Cellular, PCS, CDPD, Wireless Data, SONET**

Symbol	Parameter	Frequency	Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1dB Compression	850 MHz 1950 MHz 2400 MHz	dBm dBm dBm		17.7 18.1 18.1	
OIP_3	Output Third Order Intercept Point	850 MHz 1950 MHz 2400 MHz	dBm dBm dBm	30.2	33.2 31.1 30.7	
S_{21}	Small Signal Gain	850 MHz 1950 MHz 2400 MHz	dB dB dB	18	20.0 19.0 18.6	
Bandwidth	(Determined by S_{11}, S_{22} Values)		MHz		4000	
$VSWR_{IN}$	Input VSWR	DC-4000 MHz	-		1.4:1	
$VSWR_{OUT}$	Output VSWR	DC-4000 MHz	-		1.8:1	
S_{12}	Reverse Isolation	850 MHz 1950 MHz 2400 MHz	dB dB dB		22.7 22.5 22.2	
NF	Noise Figure	1950 MHz	dB		4.0	
V_D	Device Operating Voltage		V	4.4	4.8	5.2
R_{TH}, j-l	Thermal Resistance (junction - lead)		° C/W		224	

Test Conditions: V_S = 8 V, R_{BIAS} = 51 Ohms, I_D = 65 mA Typ., T_L = 25ºC, OIP_3 Tone Spacing = 1 MHz, Pout per tone = 0 dBm, $Z_S = Z_L$ = 50 Ohms

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Absolute Maximum Ratings

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

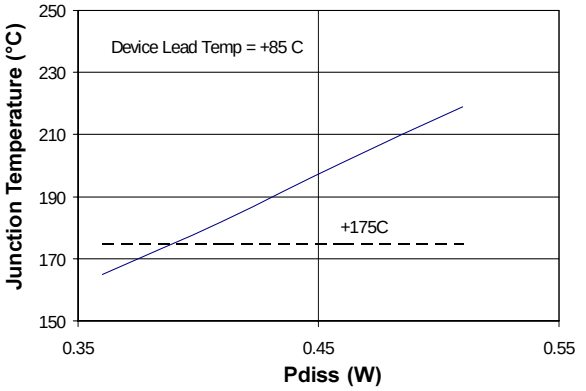
Bias Conditions should also satisfy the following expression: $I_D V_D$ (max) < (T_J - T_{OP})/Rth, j-l

Parameter	Value	Unit
Supply Current	120	mA
Operating Temperature	-40 to +85	C
Maximum Input Power	16	dBm
Storage Temperature Range	-40 to +150	C
Operating Junction Temperature	+175	C

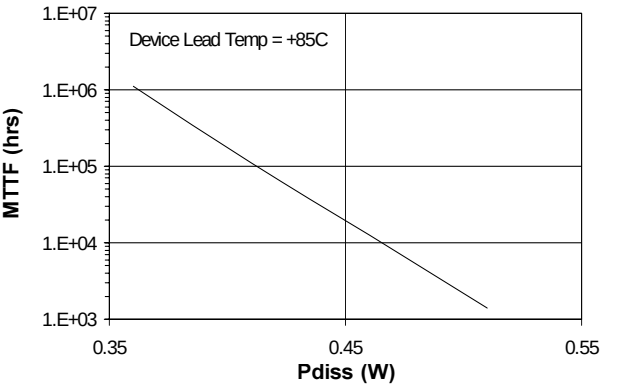
Parameter	Typical 25°C	Unit	Test Condition (I_D = 65 mA, unless otherwise noted)
500 MHz			
Gain	20.2	dB	
Noise Figure	3.9	dB	Z_S = 50 Ohms
Output IP3	32.3	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	17.5	dBm	
Input Return Loss	14.0	dB	
Isolation	22.6	dB	
850 MHz			
Gain	20.0	dB	
Noise Figure	4.0	dB	Z_S = 50 Ohms
Output IP3	33.2	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	17.7	dBm	
Input Return Loss	13.7	dB	
Isolation	22.7	dB	
1950 MHz			
Gain	19.0	dB	
Noise Figure	4.0	dB	Z_S = 50 Ohms
Output IP3	31.1	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	18.1	dBm	
Input Return Loss	15.8	dB	
Isolation	22.4	dB	
2400 MHz			
Gain	18.6	dB	
Output IP3	30.7	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	18.1	dBm	
Input Return Loss	18.7	dB	
Isolation	22.2	dB	

***NOTE:** While the SCA-4 can be operated at different bias currents, 65 mA is the recommended bias for lower junction temperature and longer life. This reflects typical operating conditions which we have found to be an optimal balance between high IP3 and MTTF. In general, MTTF is improved to more than 100,000 hours when biasing at 65 mA and operating up to 85°C ambient temperature.

Junction Temp vs. Dissipated Power

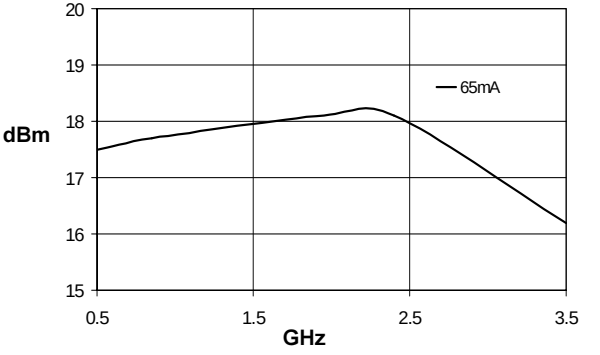


MTTF vs. Dissipated Power

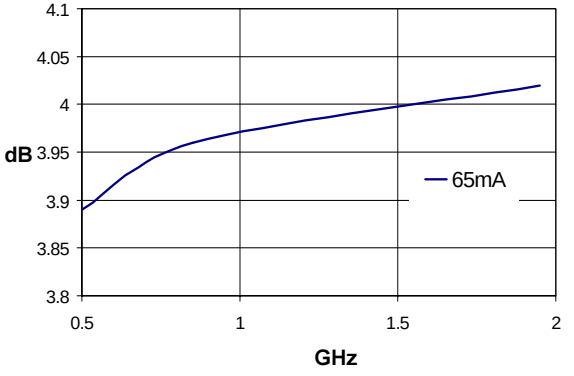


Output IP3 vs. Frequency

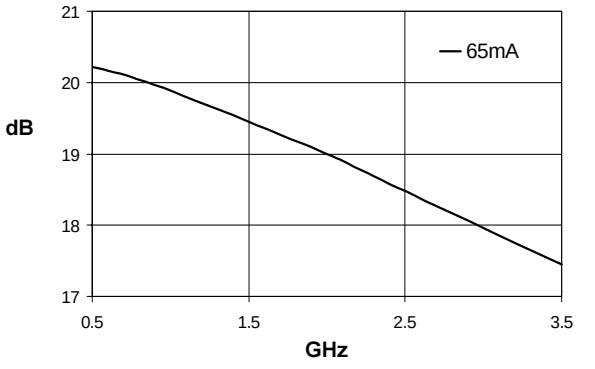
Output P1dB vs. Frequency



NF vs. Frequency



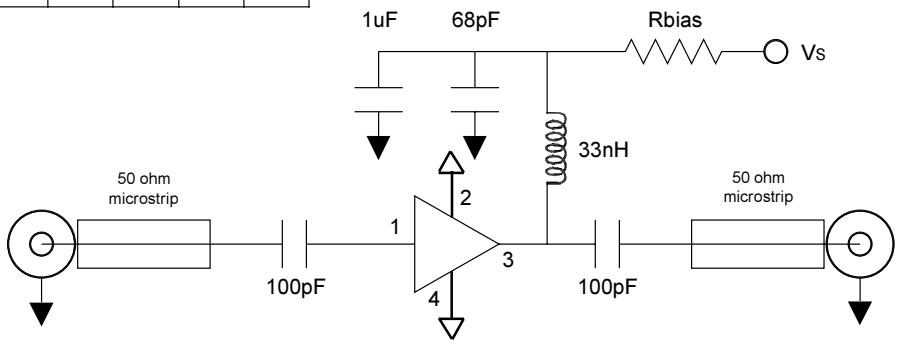
Small Signal Gain vs. Frequency



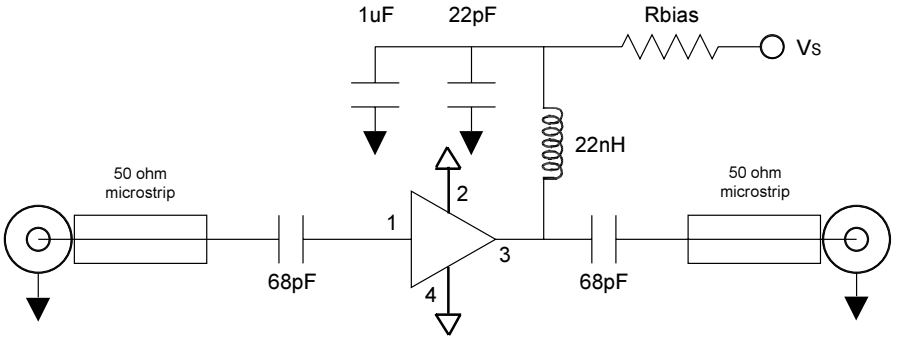
Pin #	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
2	GND	Connection to ground. Use via holes for best performance to reduce lead inductance. Place vias as close to ground leads as possible.
3	RF OUT/Vcc	RF output and bias pin. Bias should be supplied to this pin through an external series resistor and RF choke inductor. Because DC biasing is present on this pin, a DC blocking capacitor should be used in most applications (see application schematic). The supply side of the bias network should be well bypassed.
4	GND	Same as Pin 2.

Application Schematic for Operation at 850 MHz

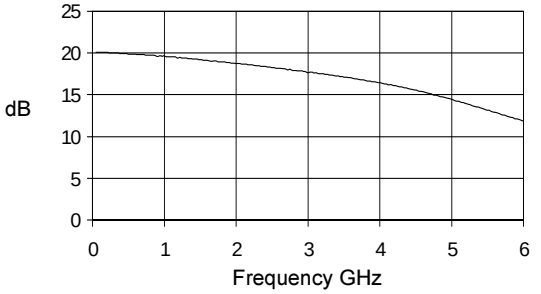
Recommended Bias Resistor Values				
Supply Voltage(Vs)	8V	9V	12V	15V
Rbias (Ohms) @ 65 mA	51	68	110	160



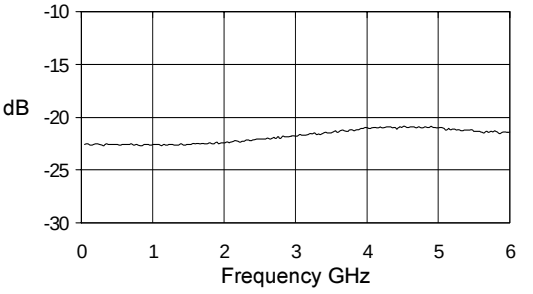
Application Schematic for Operation at 1950 MHz



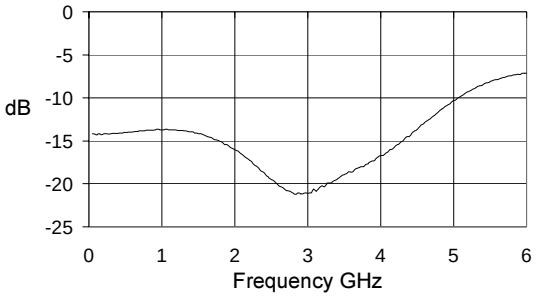
S21, I_D=65mA, T=25°C



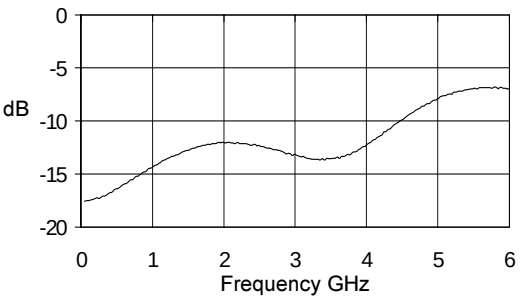
S12, I_D=65mA, T=25°C



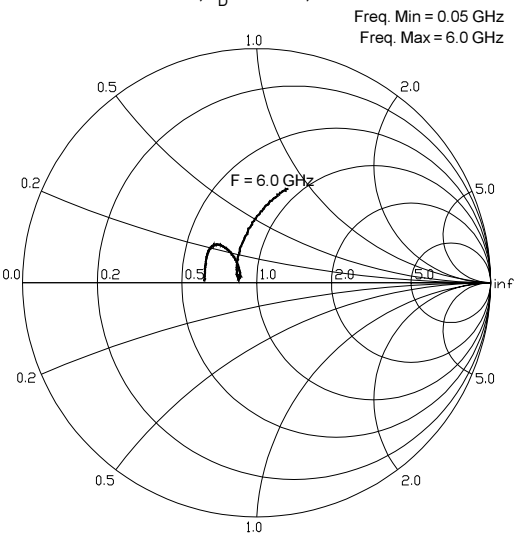
S11, I_D=65mA, T=25°C



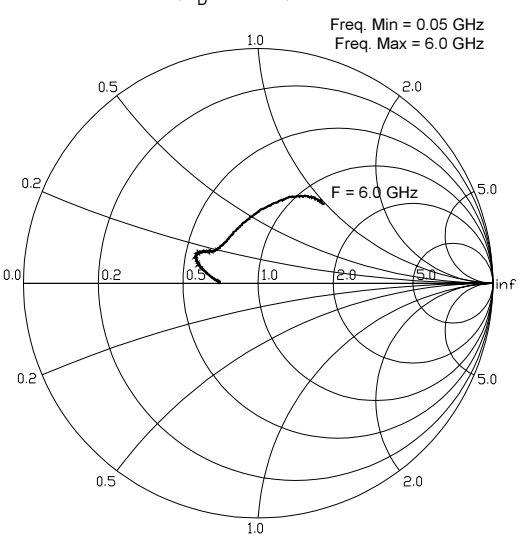
S22, I_D=65mA, T=25°C



S11, I_D=65mA, Ta=25°C



S22, I_D=65mA, Ta=25°C



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

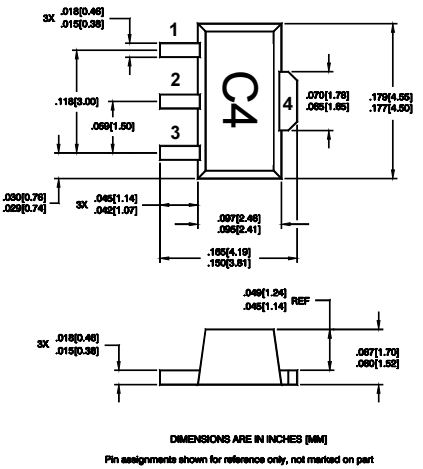
Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
SCA-4	7"	1000

Part Symbolization

The part will be symbolized with a "C4" designator on the top surface of the package.

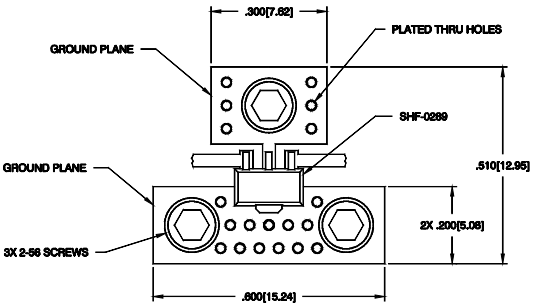
Outline Drawing



Mounting Instructions

The data shown was taken on a 31 mil thick FR-4 board with 1 ounce of copper on both sides.
The board was mounted to a baseplate with 3 screws as shown. The screws bring the top side copper temperature to the same value as the baseplate.

1. Use 1 or 2 ounce copper, if possible.
2. Solder the copper pad on the backside of the device package to the ground plane.
3. Use a large ground pad area with many plated through-holes as shown.
4. If possible, use at least one screw no more than 0.2 inch from the device package to provide a low thermal resistance path to the baseplate of the package.
5. Thermal resistance from ground lead to screws is 2 deg. C/W.



PCB Pad Layout