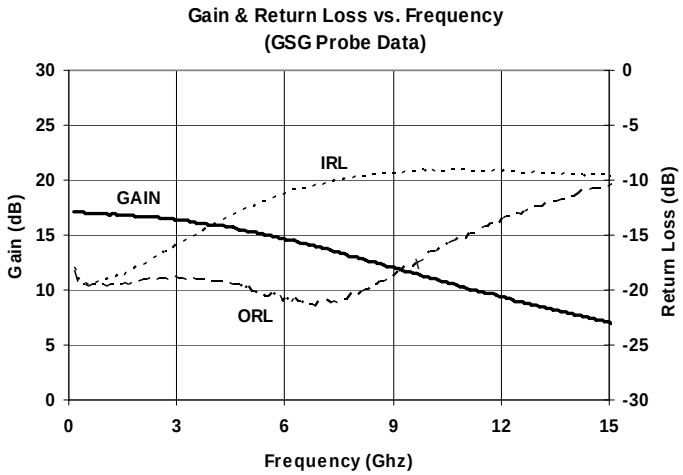
Preliminary

# SUF-4000

## 0.15-10 GHz, Cascadable pHEMT MMIC Amplifier

## Product Description

Sirenza Microdevices' SUF-4000 is a monolithically matched broadband high IP3 gain block covering 0.15-10 GHz. This pHEMT FET-based amplifier uses a patented self-bias Darlington topology featuring a gain and temperature compensating active bias network that operates from a single 5V supply. It offers efficient, cascadable performance in a compact 0.88 x 0.80 mm$^2$ die. It is well-suited for RF, LO, and IF driver applications.




## Product Features

- **Broadband Performance**
- **High Gain = 17.0 dB @ 2 GHz**
- **P1dB = 21 dBm @ 2 GHz**
- **Low-noise, Efficient Gain Block**
- **5V Operation, No Dropping Resistor**
- **Low Gain Variation vs. Temperature**
- **Patented Thermal Design**
- **Patented Self-Bias Darlington Topology**

## Applications

- **Broadband Communications**
- **Test Instrumentation**
- **Military & Space**
- **LO and IF Mixer Applications**
- **High IP3 RF Driver Applications**

| Symbol | Parameters | Units | Frequency | Min. | Typ. | Max. |
|---|---|---|---|---|---|---|
| $G_p$ | Small Signal Power Gain | dB | 2 GHz<br>6 GHz | | 17.0<br>14.5 | |
| P1dB | Output Power at 1dB Compression | dBm | 2 GHz<br>6 GHz | | 21.0<br>20.0 | |
| OIP3 | Output Third Order Intercept Point | dBm | 2 GHz<br>6 GHz | | 32.0<br>30.5 | |
| NF | Noise Figure | dB | 2 GHz<br>6 GHz | | 2.8<br>3.7 | |
| IRL | Input Return Loss | dB | 2 GHz<br>6 GHz | | 12.0<br>-11.5 | |
| ORL | Output Return Loss | dB | 2 GHz<br>6 GHz | | -18.0<br>-20.0 | |
| Isol | Reverse Isolation | dB | 2 GHz<br>6 GHz | | -21.0<br>-20.0 | |
| $V_D$ | Device Operating Voltage | V | | | 5.0 | |
| $I_D$ | Device Operating Current | mA | | | 73 | |
| $\Delta G/\Delta T$ | Gain Variation vs. Temperature | dB/°C | | | 0.01 | |
| Rth, j-l | Thermal Resistance (junction-to-backside) | °C/W | | | 164 | |

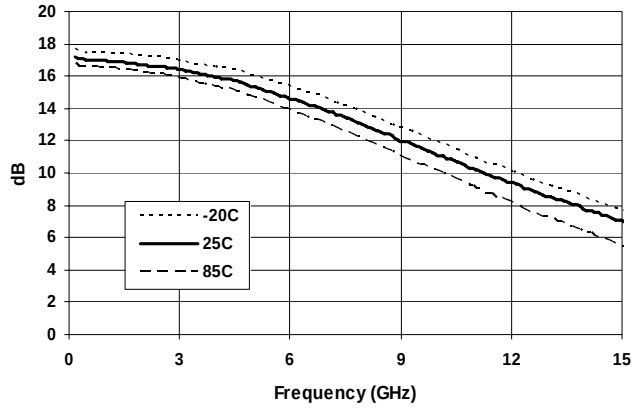
**Test Conditions:** $V_S$ = 5.0V, $I_D$ = 73mA, OIP3 Tone Spacing = 1MHz, Pout per tone = 0 dBm
$Z_S = Z_L$ = 50 Ohms, 25C, GSG Probe Data With Bias Tees



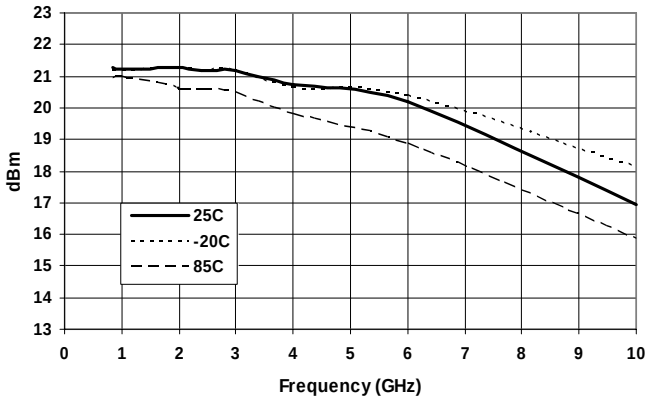
303 S. Technology Ct.
Broomfield, CO 80021
Phone: (800) SMI-MMIC
http://www.sirenza.com

## Typical Performance (GSG Probe Data)

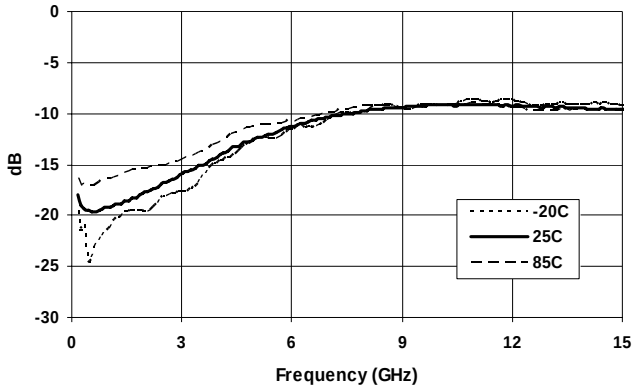
S21 vs. Frequency



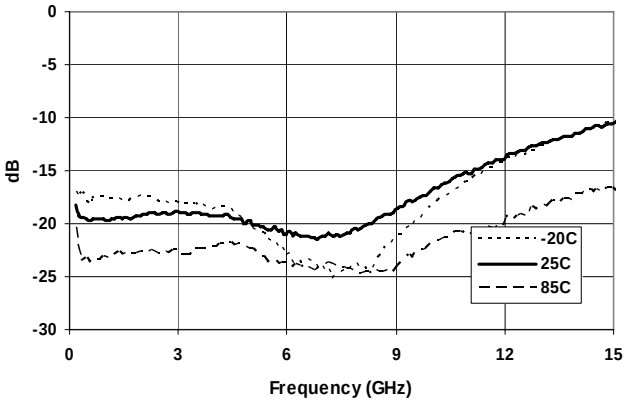

P1dB vs. Frequency



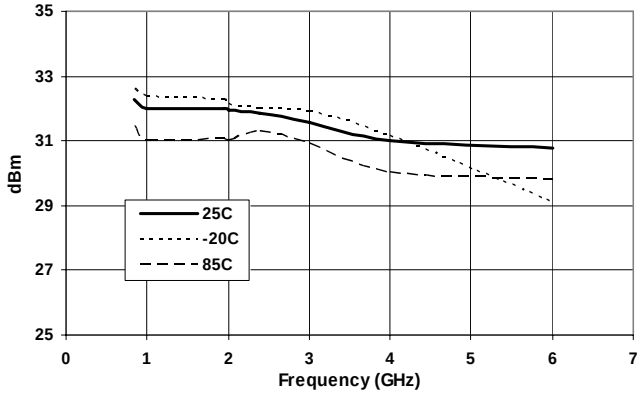

S11 vs. Frequency



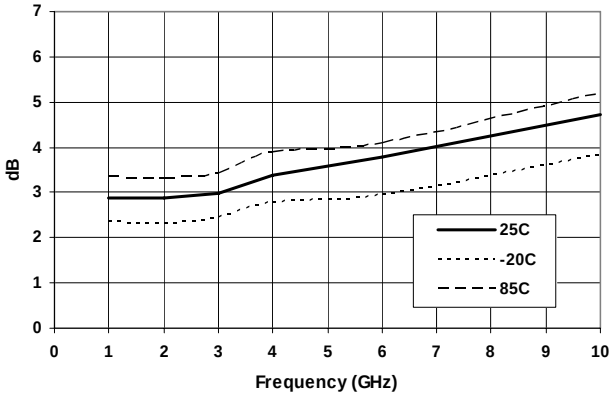

S22 vs. Frequency




$OIP_3$ vs. Frequency




Noise Figure vs. Frequency



## Typical Performance (GSG Probe Data)

| Freq (GHz) | $V_D$ (V) | Current (mA) | Gain (dB) | P1dB (dBm) | OIP3 (dBm) | S11 (dB) | S22 (dB) | NF (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.15 | 5 | 73 | 17.0 | | | -18.0 | -18.0 | |
| 0.50 | 5 | 73 | 17.0 | | | -19.5 | -19.5 | |
| 0.85 | 5 | 73 | 17.0 | 21.0 | 32.5 | -20.0 | -19.0 | 2.8 |
| 2.0 | 5 | 73 | 17.0 | 21.0 | 32.0 | -18.5 | -18.5 | 2.8 |
| 4.0 | 5 | 73 | 16.0 | 20.5 | 31.0 | -14.5 | -18.5 | 3.3 |
| 6.0 | 5 | 73 | 14.5 | 20.0 | 30.5 | -11.5 | -20.0 | 3.7 |
| 10.0 | 5 | 73 | 11.0 | | | -9.0 | -16.5 | 4.7 |

**Test Conditions:** GSG Probe Data With Bias Tees, OIP3 Tone Spacing = 1MHz, Pout per tone = 0 dBm, 25C

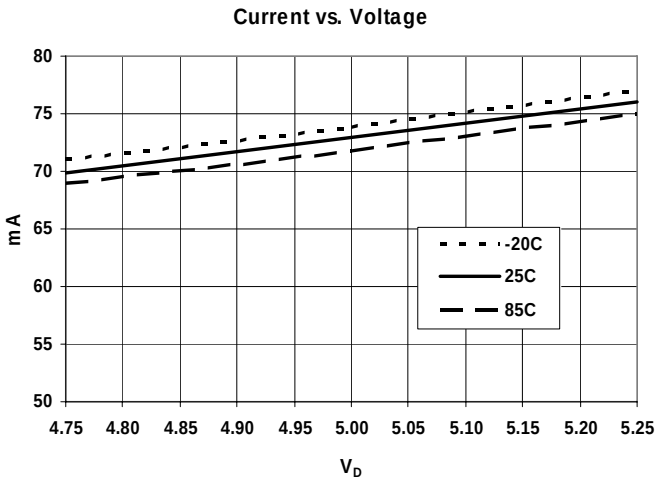
| Parameter | Absolute Limit |
|---|---|
| Max Device Current ($I_D$) | 80mA |
| Max Device Voltage ($V_D$) | 5.5V |
| Max RF Input Power | 10dBm |
| Max Dissipated Power | 440mW |
| Max Junction Temperature ($T_J$) | 150C |
| Operating Temperature Range ($T_L$) | -40 to +85C |
| Max Storage Temp. | -65 to 150C |

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:

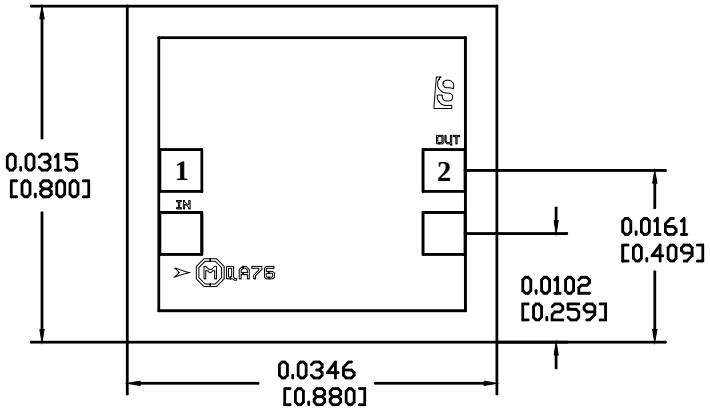
$I_D V_D < (T_J - T_L) / R_{TH}$, j-l  $T_L$=Backside of die

## *Current Variation vs. Temperature*




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

## Pad Description




| Pad # | Function | Description |
|---|---|---|
| 1 | $RF_{IN}$ | This pad is DC coupled and matched to 50 Ohms. An external DC block is required. |
| 2 | $RF_{OUT}$ / Bias | This pad is DC coupled and matched to 50 Ohms. Bias is applied through this pad. |
| Die Bottom | GND | Die bottom must be connected to RF/DC ground using silver-filled conductive epoxy. |

**Notes:**
1. All Dimensions in Inches [Millimeters].
2. No connection required for unlabeled bond pads.
3. Die Thickness is 0.004 (0.100).
4. Typical bond pad is 0.004 (0.100) square.
5. Backside metalization: Gold.
6. Backside is Ground.
7. Bond pad metalization: Gold.

## Device Assembly