

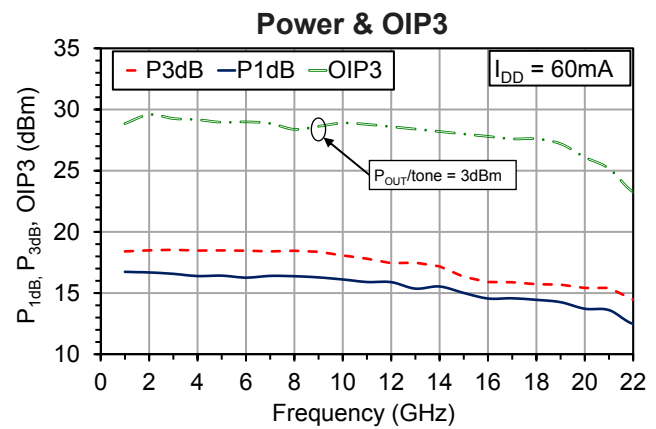
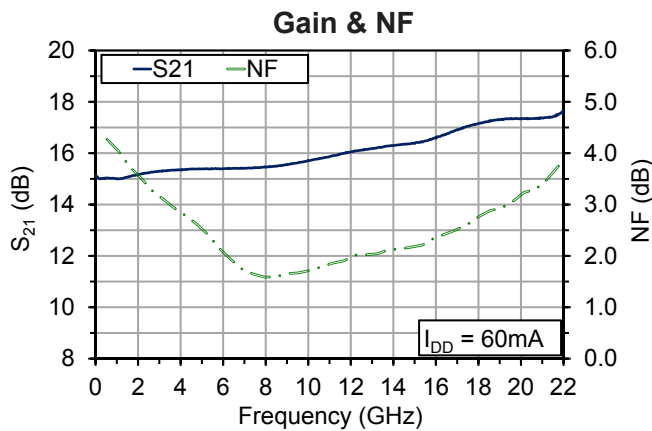
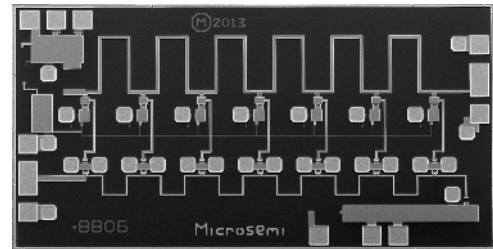
# DC-22GHz, 16dB Gain Low-Noise Wideband Distributed Amplifier

## Features

- Excellent combination of wide bandwidth, low noise and high associated gain
- 1.7dB NF with >15.5dB gain at 10GHz
- Output IP3 ~26-29dBm
- Input and output matched to 50Ω
- 100% DC and RF tested
- Chip size: 2.82mm x 1.50mm x 0.1mm

## Applications

- Instrumentation
- Electronic warfare
- Microwave communications
- Radar



**Typical Performance (CW, Typical Device, RF Probe):**  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 8\text{V}$ ,  $I_{DD} = 60\text{mA}^1$

Parameter	DC - 6GHz	6 - 18GHz	18 - 22GHz	Units
Small Signal Gain	15	16	17	dB
Noise Figure	3.0	2.0	3.2	dB
Output Return Loss	15	15	12	dB
Output Power, P <sub>1dB</sub>	16	15	13	dBm
Output Power P <sub>3dB</sub>	18	17	15	dBm
Output IP3	29	28	25	dBm

<sup>1</sup> Adjust  $V_{GG}$  to set  $I_{DD} = 60\text{mA}$ , typical value is  $-0.5\text{V}$ . Recommend  $I_{DD} \sim 45\text{mA}$  for improved stability down to  $-55^\circ\text{C}$

**Table 1: Absolute Maximum Ratings, Not Simultaneous**

Parameter	Rating	Units
Drain Voltage ( $V_{DD}$ )	+9	V
Gate Voltage ( $V_{GG}$ )	-2 to 0	V
Input Power ( $P_{IN}$ )	20	dBm
Channel Temperature ( $T_C$ )	150 <sup>2</sup>	°C
Operating Ambient Temperature ( $T_A$ )	-55 to +85	°C
Storage Temperature	-65 to +150	°C
Thermal Resistance, Channel to Die Backside ( $R_{TH}$ )	40	°C/W



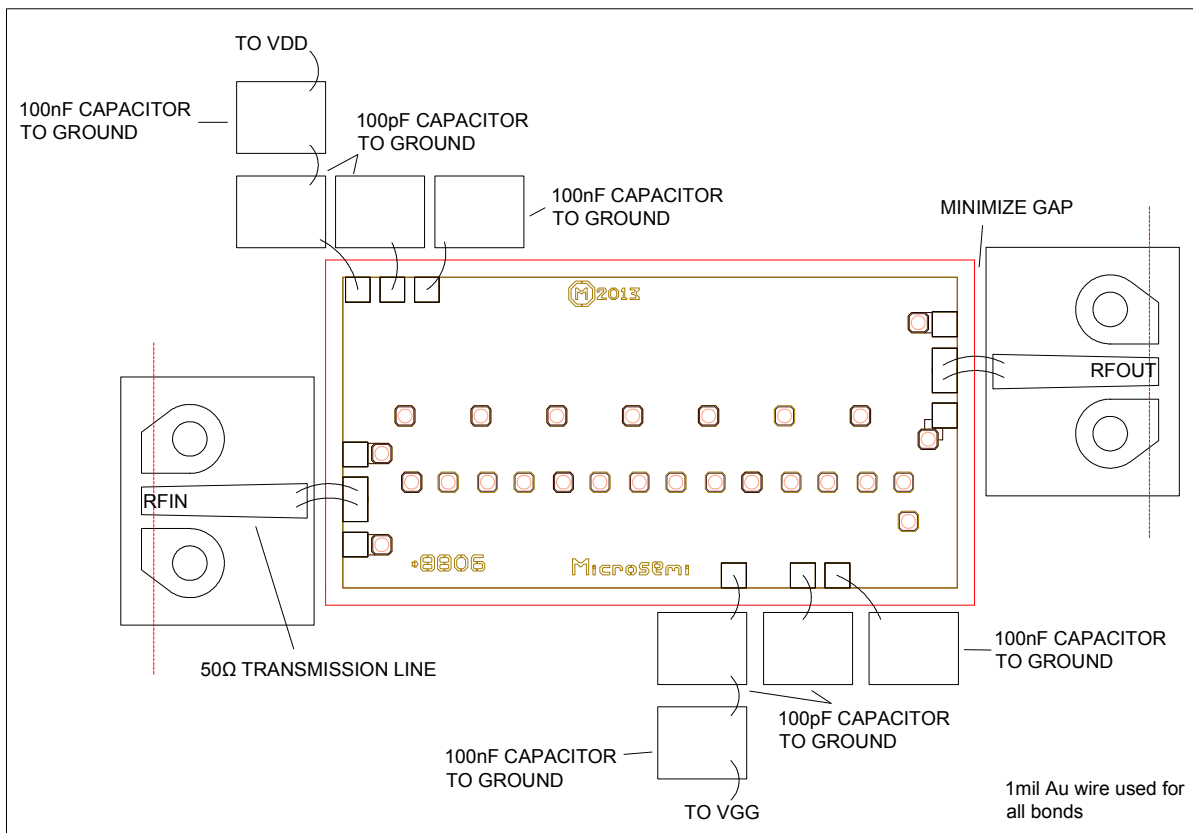
Caution, ESD Sensitive Device

<sup>2</sup> MTTF > 10<sup>8</sup> hours at  $T_C = 150^\circ\text{C}$ 
**Table 2: Specifications (CW, 100% Test):  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 8\text{V}$ ,  $I_{DD} = 60\text{mA}$ <sup>3</sup>**

Parameter	Frequency	Min	Typ	Max	Units
Small Signal Gain	20GHz	14.5	17	-	dB
Output Power, $P_{1dB}$	20GHz	12	14	-	dBm

<sup>3</sup> Adjust  $V_{GG}$  to get  $I_{DD} = 60\text{mA}$ , typical value is -0.5V

## RF Probe Measurement Set-Up With Reference Planes<sup>4</sup>



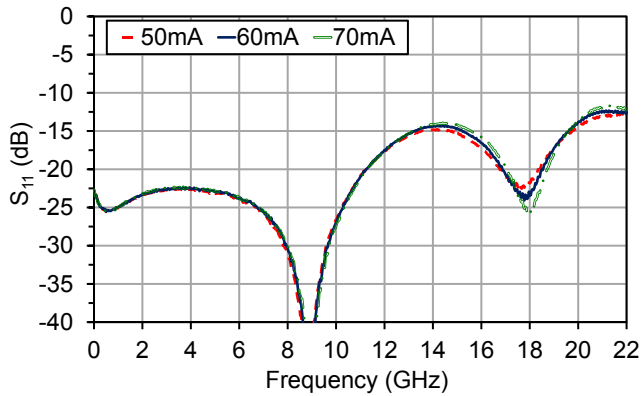
External DC blocks maybe required, refer to Table 3 for more information.

<sup>4</sup> Reference planes are the same for S-parameter files downloadable on [www.microsemi.com/mmics](http://www.microsemi.com/mmics)

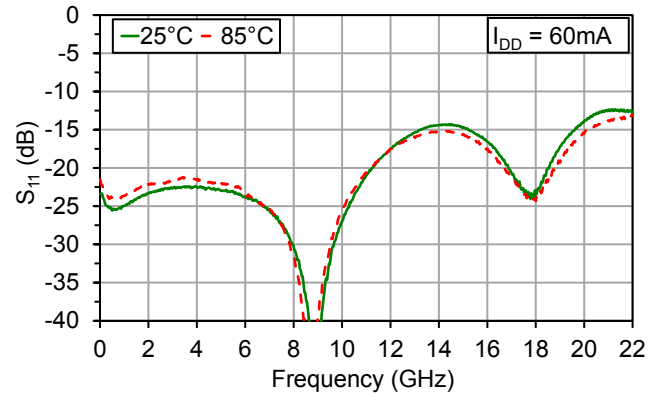
## Typical Performance, RF Probe

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

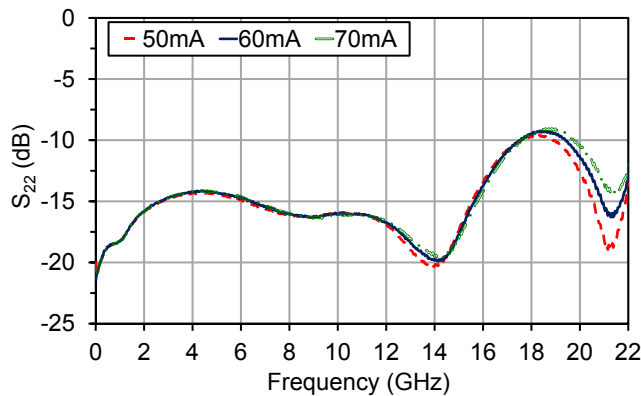
### $S_{11}$ Over Bias Current



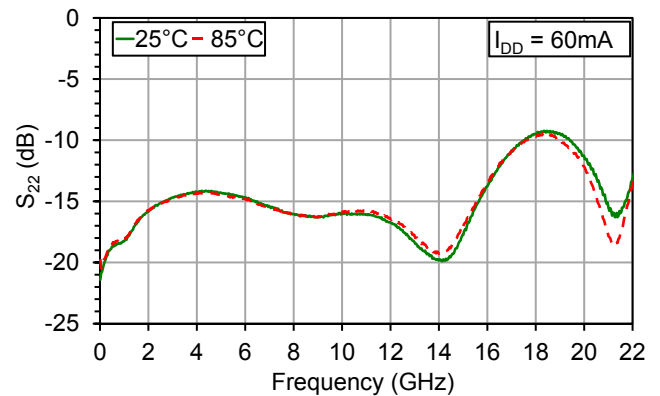
### $S_{11}$ Over Temperature



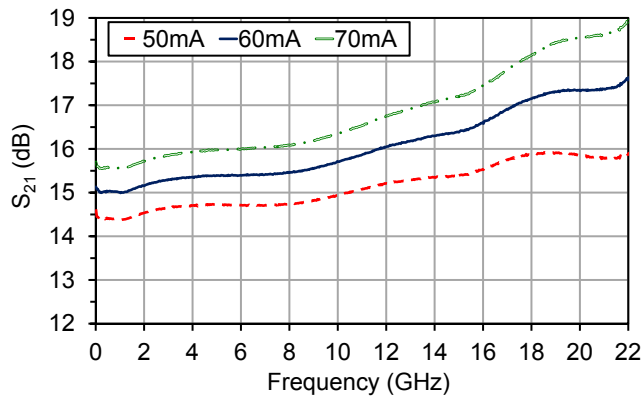
### $S_{22}$ Over Bias Current



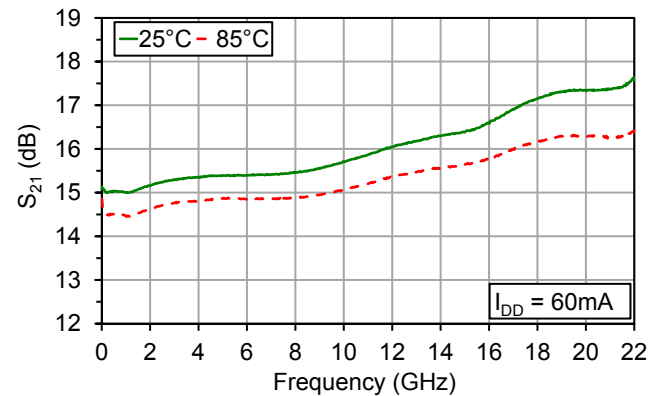
### $S_{22}$ Over Temperature



### $S_{21}$ Over Bias Current



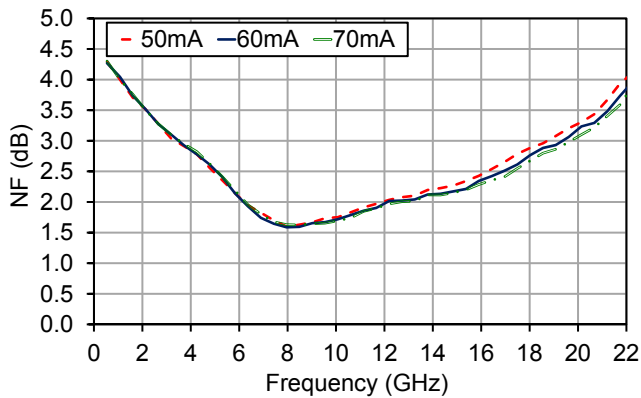
### $S_{21}$ Over Temperature



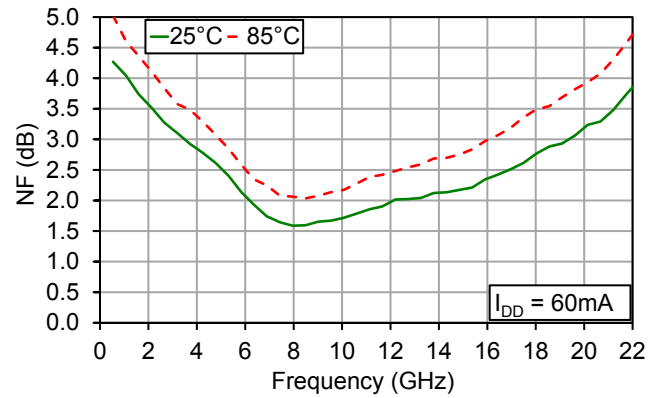
## Typical Performance, RF Probe

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

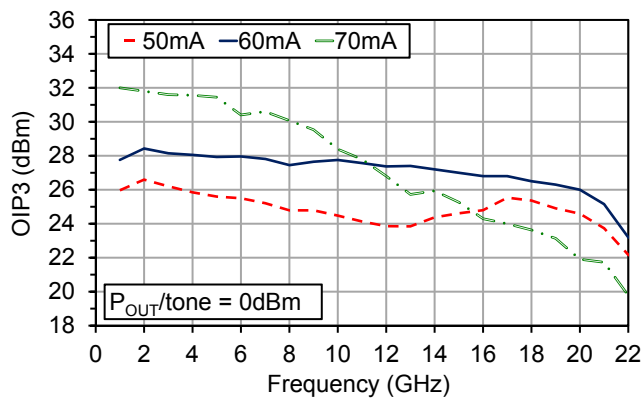
### Noise Figure Over Bias Current



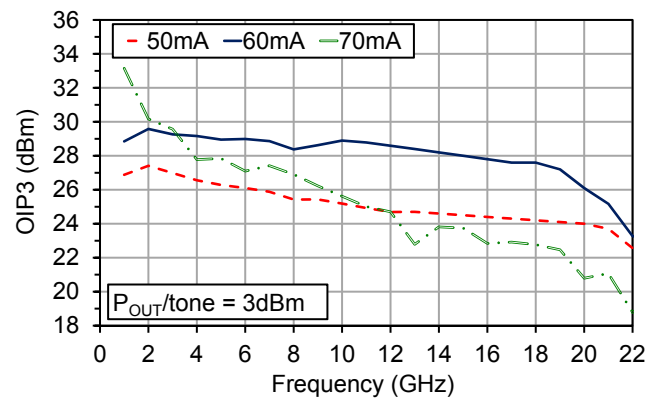
### Noise Figure Over Temperature



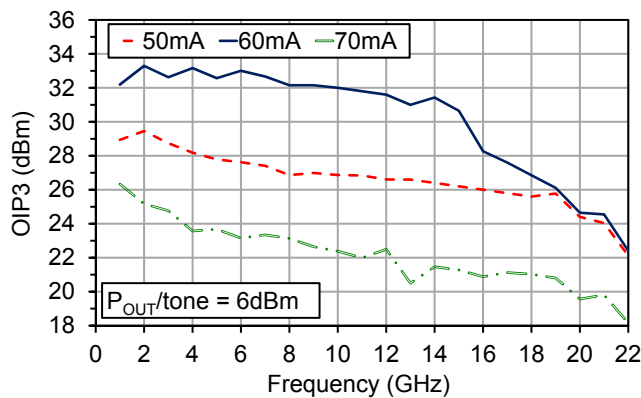
### OIP3 Over Bias Current, 0dBm/tone



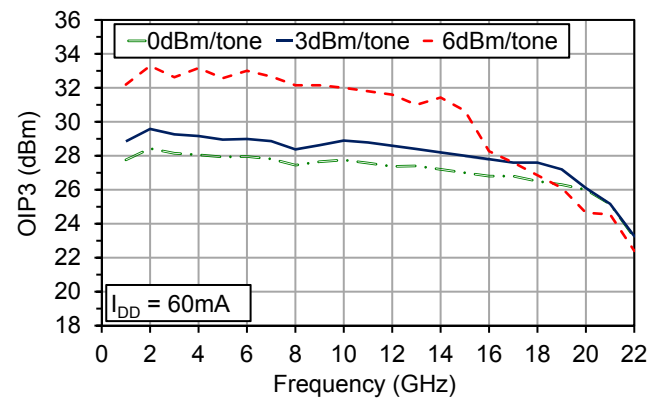
### OIP3 Over Bias Current, 3dBm/tone



### OIP3 Over Bias Current, 6dBm/tone



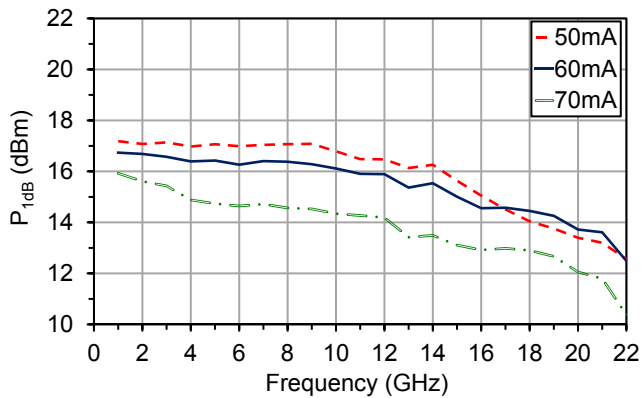
### OIP3 Over Output Power Per Tone



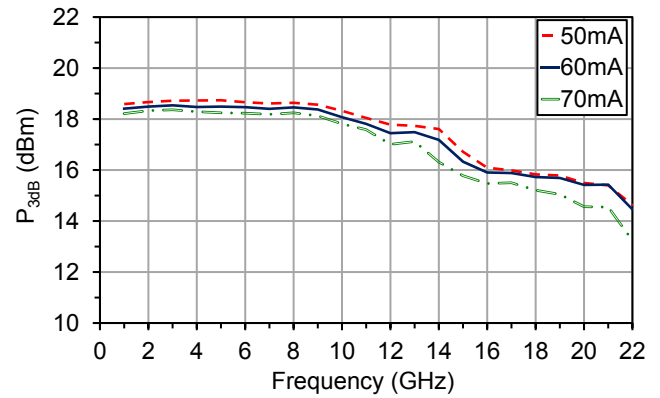
## Typical Performance, RF Probe

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

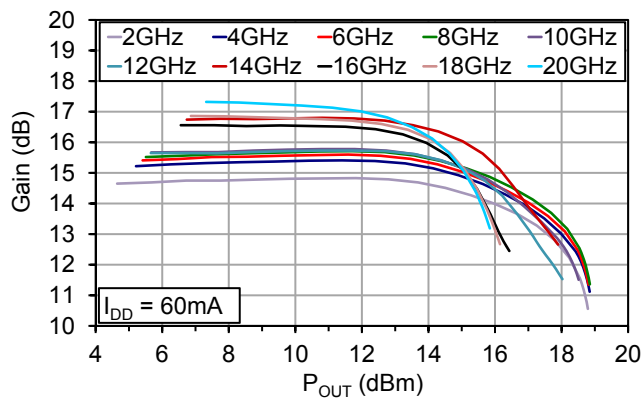
**$P_{1dB}$  Over Bias Current**



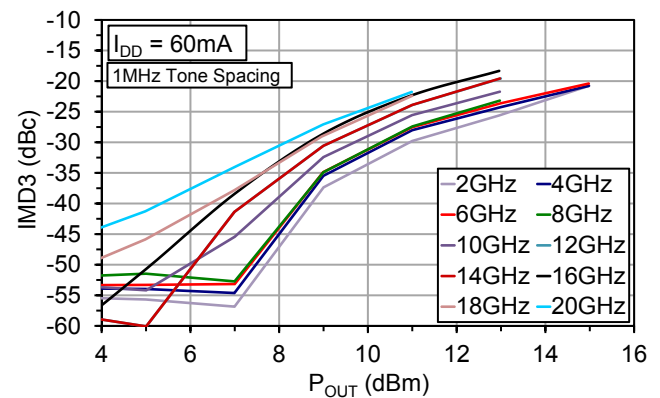
**$P_{3dB}$  Over Bias Current**



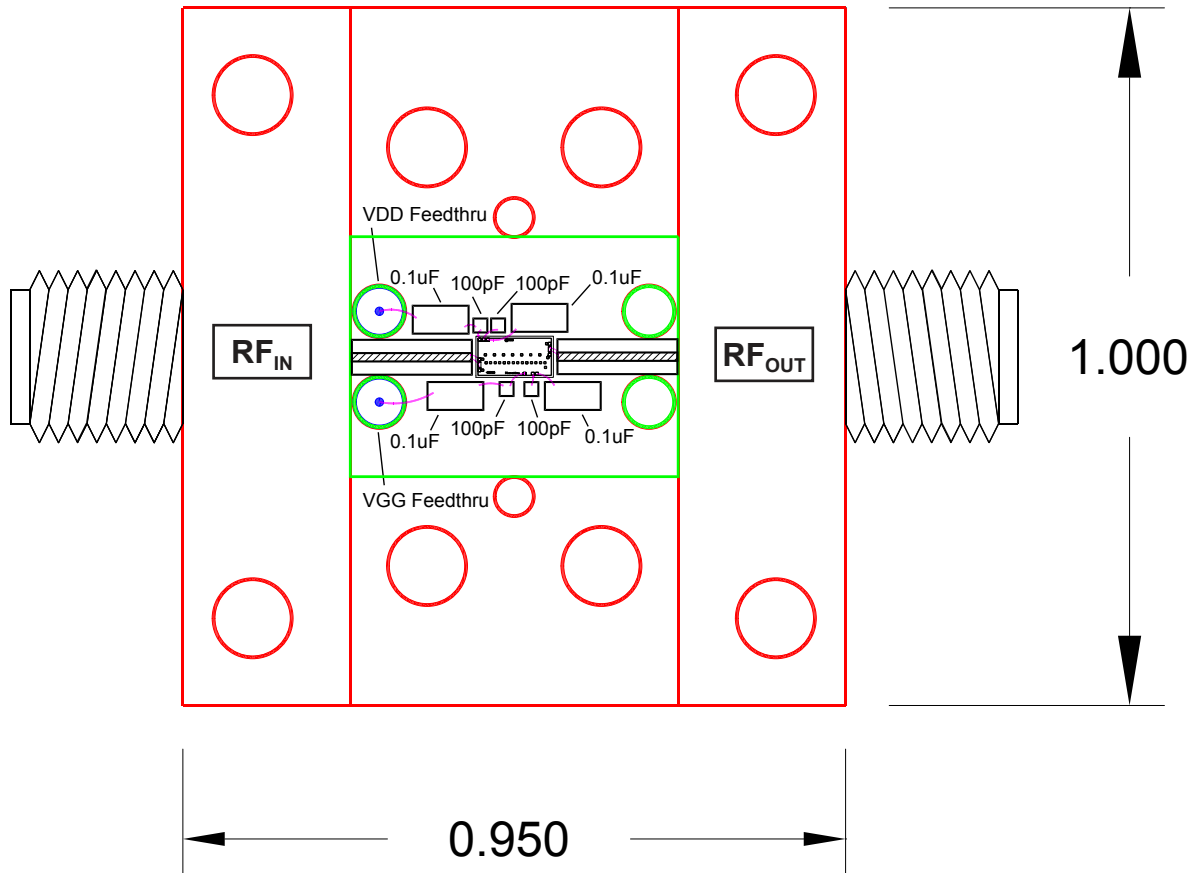
**Power Sweep**



**IMD3 Sweep**



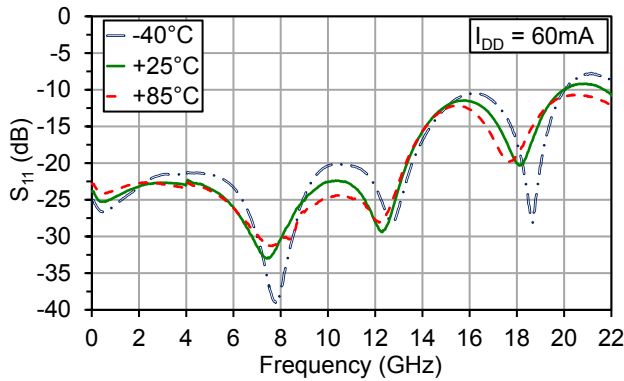
### Connectorized Test Fixture With SMK 2.92mm Connectors



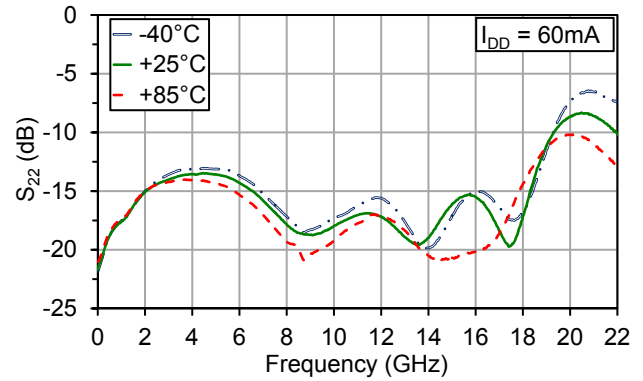
## Typical Performance, Connectorized Test Fixture

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

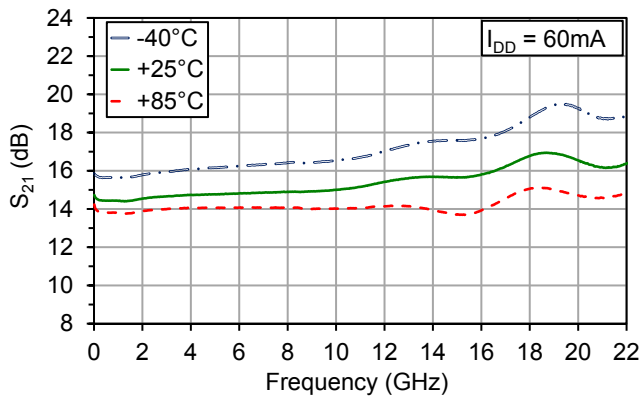
### $S_{11}$ Over Temperature



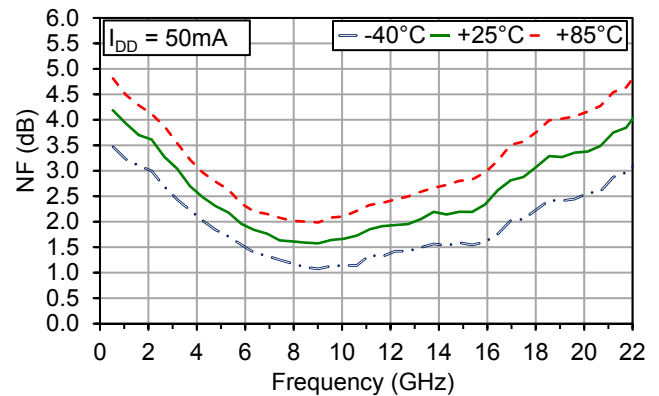
### $S_{22}$ Over Temperature



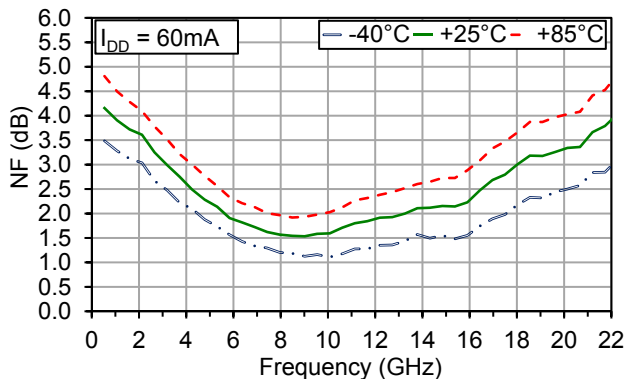
### $S_{21}$ Over Temperature



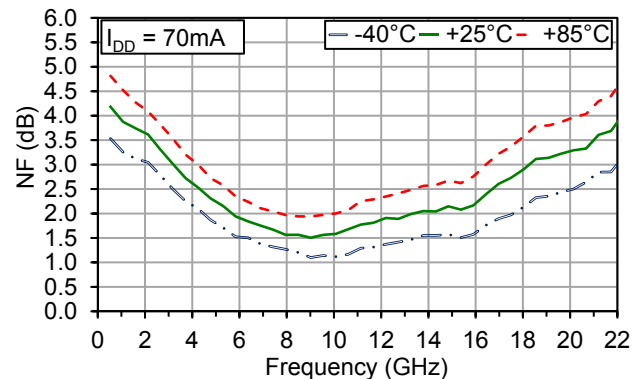
### NF Over Temperature, $I_{DQ} = 50mA$



### NF Over Temperature, $I_{DQ} = 60mA$



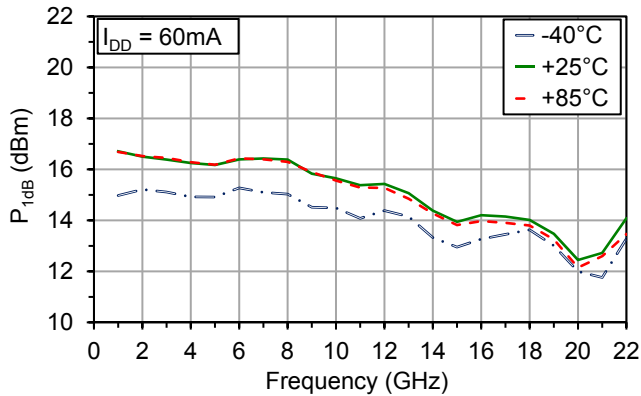
### NF Over Temperature, $I_{DQ} = 70mA$



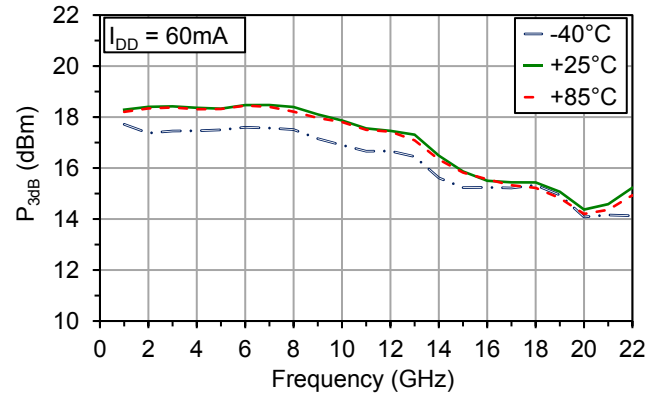
## Typical Performance, Connectorized Test Fixture

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

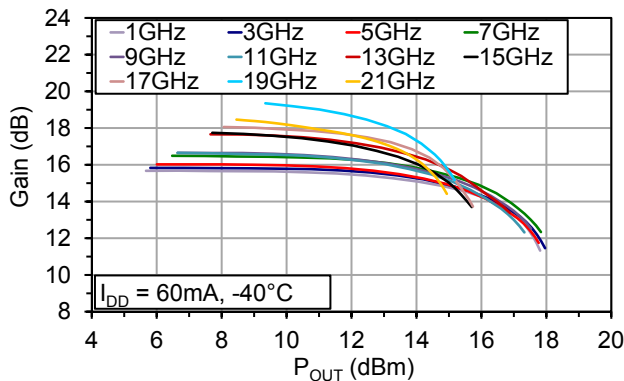
### $P_{1dB}$ Over Temperature



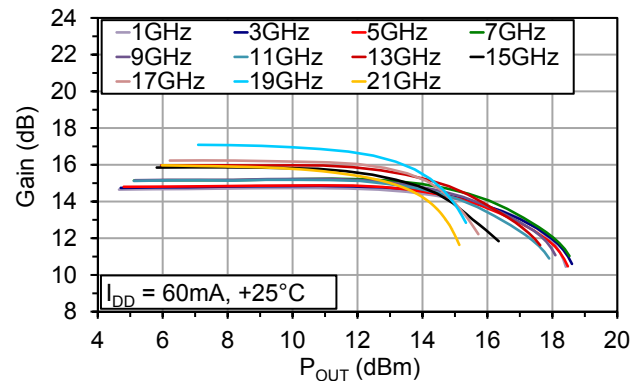
### $P_{3dB}$ Over Temperature



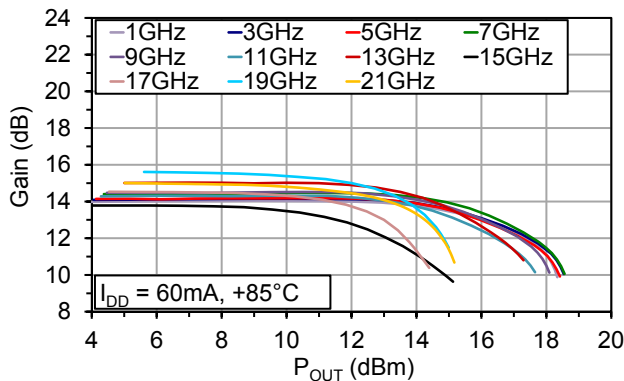
### Power Sweep, $-40^\circ C$



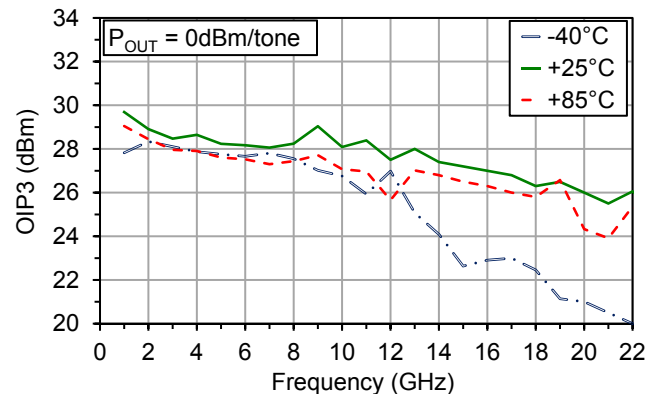
### Power Sweep, $+25^\circ C$



### Power Sweep, $+85^\circ C$



### OIP3 Over Temperature, 0dBm/tone

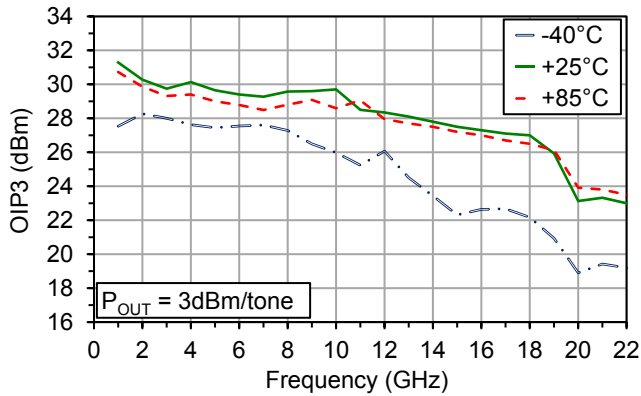




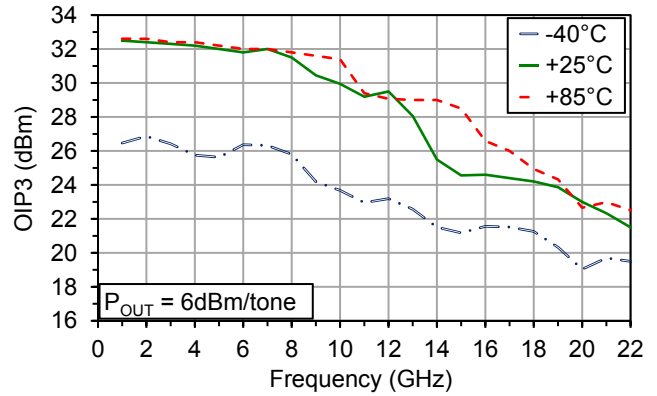
## Typical Performance, Connectorized Test Fixture

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

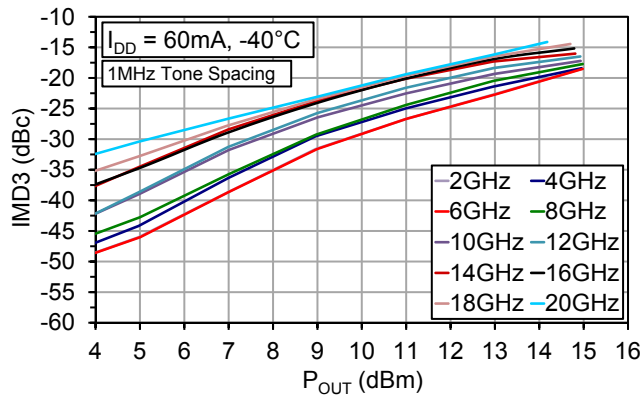
**OIP3 Over Temperature, 3dBm/tone**



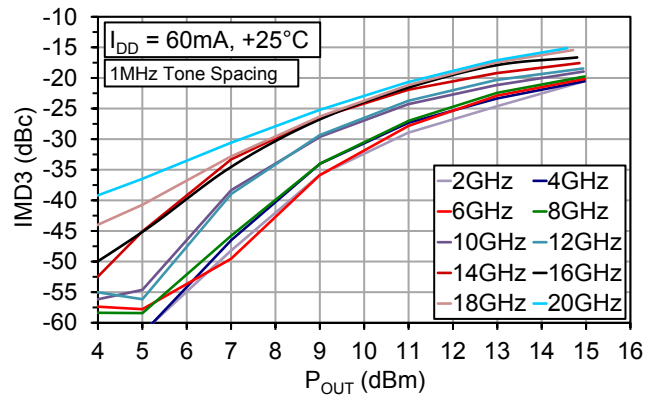
**OIP3 Over Temperature, 6dBm/tone**



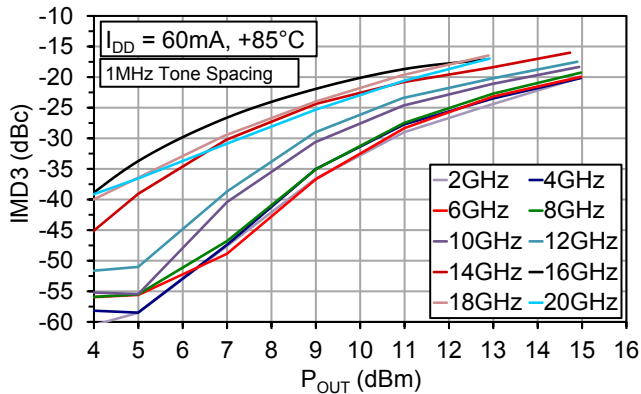
**IMD Sweep, -40°C**



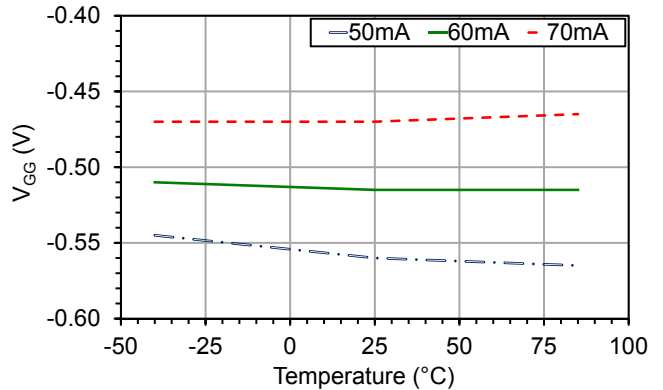
**IMD Sweep, +25°C**



**IMD Sweep, +85°C**



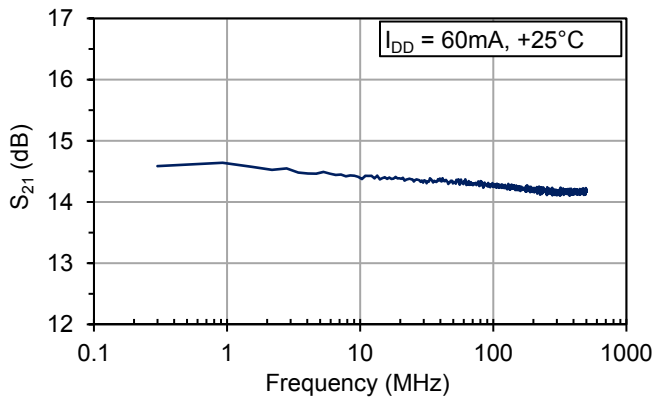
**V<sub>GG</sub> Over Temperature**



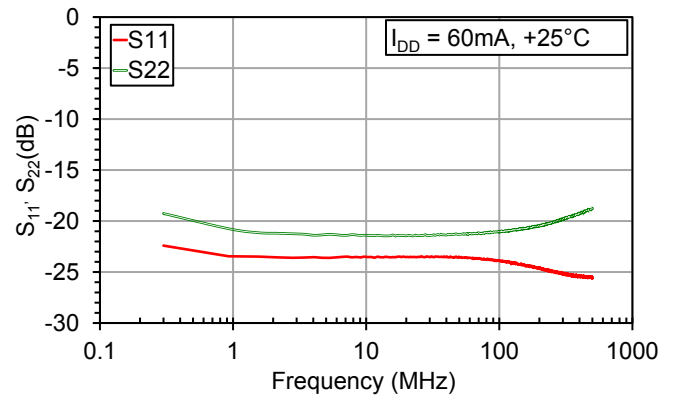
## Typical Performance, Connectorized Test Fixture

$V_{DS} = 8V$ ,  $I_{DQ} = 60mA$ ,  $T_A = 25^\circ C$  unless otherwise noted

Low-Frequency  $S_{21}$

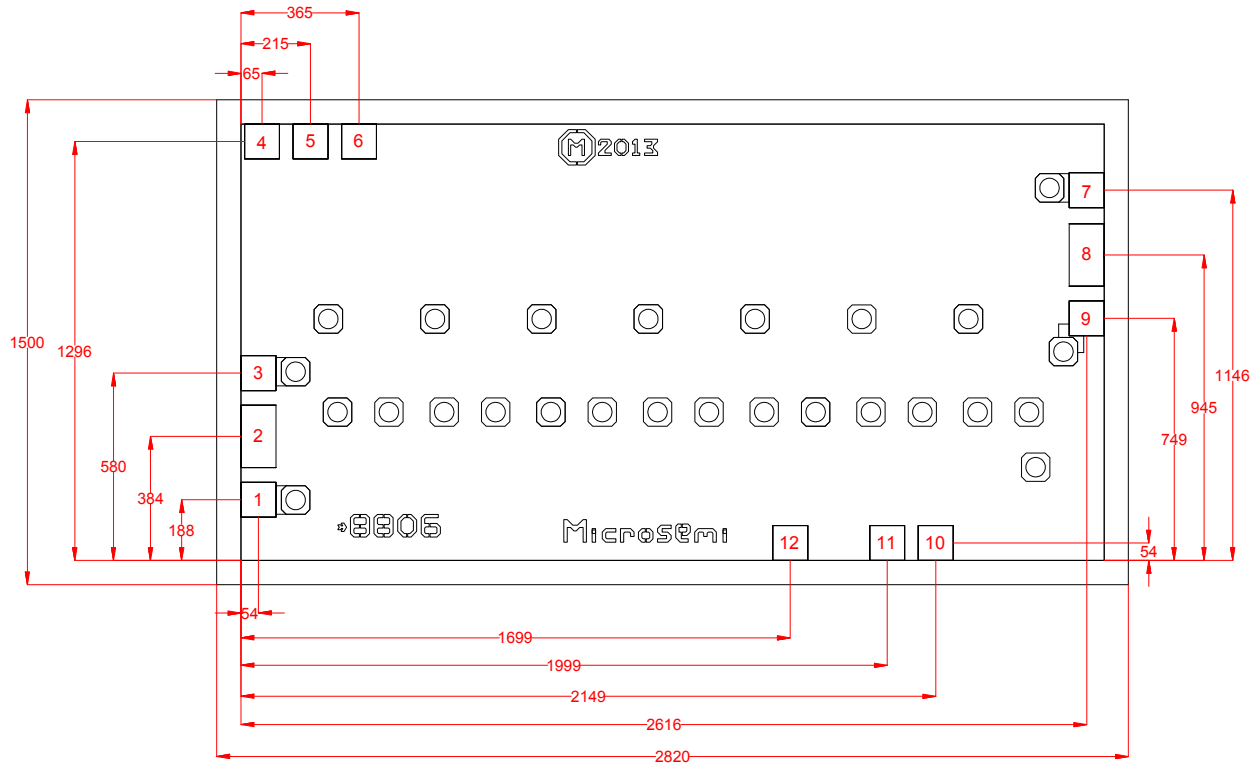


Low-Frequency  $S_{11}$ ,  $S_{22}$



**Chip layout showing pad locations.**

All dimensions are in microns. Die thickness is 100 microns. Backside metal is gold, bond pad metal is gold. Refer to Die Handling Application Note MM-APP-0001 (visit [www.microsemi.com/mmics](http://www.microsemi.com/mmics)).


**Table 3: Pad Descriptions**

Pad #	Description	Pad Dimensions ( $\mu\text{m}$ )
1, 3, 7, 9	Ground	100 x 100
2	RF <sub>IN</sub> , Pad Is DC Coupled. Use External DC block	100 x 190
8	RF <sub>OUT</sub> , Pad Is DC Coupled. Use External DC Block	100 x 190
4	V <sub>DD</sub>	100 x 100
12	V <sub>GG</sub>	100 x 100
5, 6, 10, 11	Low Frequency Terminations	100 x 100
Die Backside	Must be connected to ground	-

**Biasing**

1. Set V<sub>GG</sub> = -2V
2. Set V<sub>DD</sub> = 8V
3. Adjust V<sub>GG</sub> to set I<sub>DD</sub>

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