

## 5.8-16GHz Low Noise Amplifier

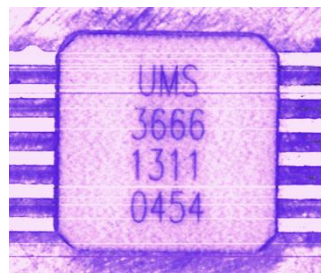
### GaAs Monolithic Microwave IC in SMD package

#### Description

The CHA3666-SNF is a two-stage self biased wide band monolithic low noise amplifier.

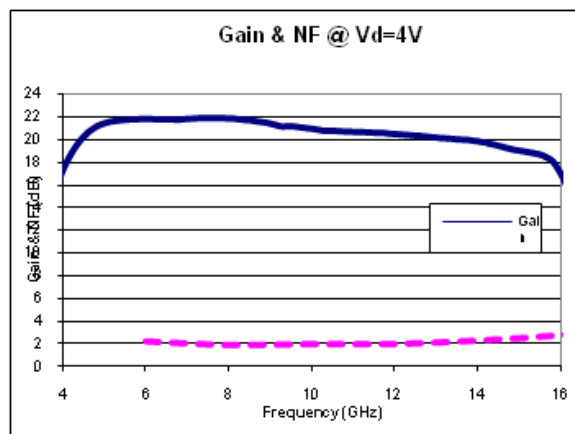
The circuit is manufactured with a standard pHEMT process: 0.25 $\mu$ m gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is supplied in lead-free, hermetic package compatible for space application.



#### Main Features

- Broadband performance 5.8-16GHz
- 2.8dB maximum noise figure
- 24dBm 3<sup>rd</sup> order intercept point
- 16dBm power at 1dB compression
- 20dB gain
- Low DC power consumption
- 12L-Glass/metal hermetic package



#### Main Electrical Characteristics

Tamb.= +25°C

| Symbol | Parameter                 | Min | Typ | Max | Unit |
|--------|---------------------------|-----|-----|-----|------|
| NF     | Noise figure              |     | 2.1 | 2.8 | dB   |
| G      | Small signal Gain         | 16  | 20  |     | dB   |
| IP3    | 3rd order intercept point |     | 24  |     | dBm  |

ESD Protections: Electrostatic discharge sensitive device observe handling precautions!

## Electrical Characteristics

T<sub>amb.</sub> = +25°C, V<sub>d</sub> = +4.0V<sup>(1)</sup>

| Symbol          | Parameter                     | Min  | Typ   | Max   | Unit |
|-----------------|-------------------------------|------|-------|-------|------|
| F <sub>op</sub> | Operating frequency range     | 5.8  |       | 16    | GHz  |
| G               | Small signal Gain             | 16   | 20    |       | dB   |
| ΔG              | Gain flatness                 |      | ±1    |       | dB   |
| NF              | Noise figure                  |      | 2.1   | 2.8   | dB   |
| IS11I           | Input return loss             |      | 2.3:1 | 3:1   |      |
| IS22I           | Output return loss            |      | 1.9:1 | 2.5:1 |      |
| IP3             | 3rd order intercept point     |      | 24    |       | dBm  |
| P1dB            | Output power at 1dB gain comp | 14.5 | 16    |       | dBm  |
| V <sub>d</sub>  | Drain bias voltage            |      | 4     |       | V    |
| I <sub>d</sub>  | Drain bias current            | 60   | 80    | 100   | mA   |

<sup>(1)</sup> These values are representative of on board measurements as defined on the drawing 96446 (see below).

## Absolute Maximum Ratings <sup>(1)</sup>

T<sub>amb.</sub> = +25°C

| Symbol           | Parameter                                  | Values      | Unit |
|------------------|--------------------------------------------|-------------|------|
| V <sub>d</sub>   | Drain bias voltage                         | 4.5         | V    |
| P <sub>in</sub>  | RF input power                             | 10          | dBm  |
| T <sub>op</sub>  | Operating temperature range <sup>(2)</sup> | -40 to +85  | °C   |
| T <sub>j</sub>   | Junction temperature <sup>(3)</sup>        | 175         | °C   |
| T <sub>stg</sub> | Storage temperature range                  | -55 to +125 | °C   |
| T <sub>stg</sub> | Storage temperature range                  | -55 to +150 | °C   |

<sup>(1)</sup> Operation of this device above any one of these parameters may cause permanent damage.

<sup>(2)</sup> T<sub>op</sub> = Package Ground Paddle back side temperature

<sup>(3)</sup> Thermal Resistance channel to ground paddle = 214°C/W for T<sub>ground paddle</sub> = +85°C

### Typical Package Sij parameters

For low current configuration in 96446 board - in connector plane  
Temp = +25°C, Vd= +4V, typical Id=80mA

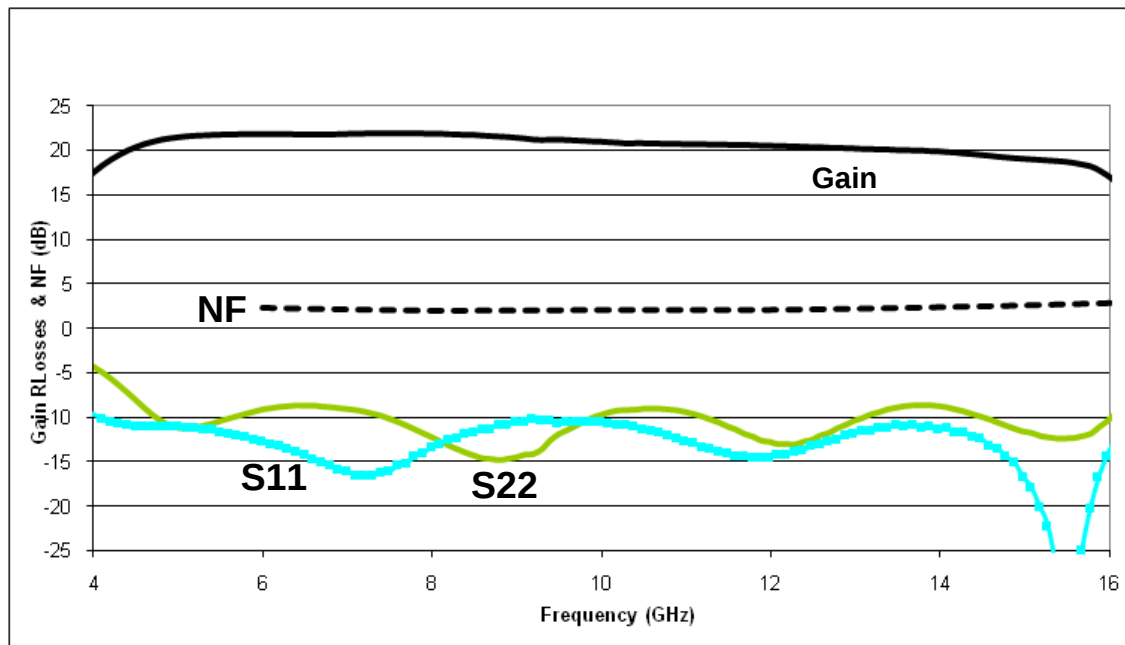
| F(GHz) | dBS11  | PhS11(°) | dBS21  | PhS21(°) | dBS12  | PhS12(°) | dBS22  | PhS22(°) | NF(dB) |
|--------|--------|----------|--------|----------|--------|----------|--------|----------|--------|
| 0.1    | -0.02  | -12.36   | -60.38 | 139.48   | -64.76 | -124.85  | -0.03  | -12.38   |        |
| 1.0    | -0.20  | -120.14  | -51.96 | 106.43   | -66.83 | 84.74    | -0.34  | -120.02  |        |
| 1.5    | -0.39  | -177.23  | -48.22 | -127.20  | -75.55 | 124.32   | -0.77  | -176.02  |        |
| 2.0    | -0.64  | 123.96   | -24.00 | 167.40   | -68.76 | -7.25    | -1.69  | 130.69   |        |
| 2.5    | -0.98  | 57.81    | -14.91 | 110.27   | -59.27 | -25.95   | -1.37  | 74.27    |        |
| 3.0    | -1.57  | -21.16   | 2.92   | 44.44    | -57.06 | -110.13  | -2.84  | -3.77    |        |
| 3.5    | -2.43  | -110.87  | 12.31  | -67.44   | -66.93 | 153.56   | -6.78  | -71.82   |        |
| 4.0    | -4.34  | 154.20   | 17.54  | -172.21  | -59.56 | -102.75  | -9.70  | -124.50  |        |
| 4.5    | -8.12  | 54.55    | 20.34  | 89.22    | -48.72 | 172.09   | -11.01 | -165.12  |        |
| 5.0    | -11.16 | -52.92   | 21.42  | -1.47    | -44.68 | 96.06    | -11.04 | 153.87   |        |
| 5.5    | -10.35 | -138.28  | 21.70  | -83.26   | -43.11 | 23.69    | -11.58 | 110.50   |        |
| 6.0    | -9.06  | 161.41   | 21.76  | -159.03  | -41.87 | -42.92   | -12.71 | 65.18    | 2.263  |
| 6.5    | -8.66  | 111.23   | 21.72  | 129.68   | -41.28 | -105.13  | -14.26 | 11.83    |        |
| 7.0    | -9.03  | 65.00    | 21.79  | 61.19    | -40.42 | -164.80  | -16.11 | -62.21   |        |
| 7.5    | -10.14 | 17.00    | 21.85  | -6.81    | -39.54 | 131.57   | -16.10 | -149.55  |        |
| 8.0    | -12.21 | -34.04   | 21.81  | -73.75   | -39.48 | 67.94    | -13.34 | 133.51   | 1.929  |
| 8.5    | -14.28 | -97.49   | 21.67  | -139.41  | -39.49 | 7.97     | -11.71 | 74.57    |        |
| 9.0    | -14.46 | -177.11  | 21.35  | 155.94   | -39.32 | -51.71   | -10.50 | 25.06    |        |
| 9.5    | -11.85 | 115.71   | 21.14  | 93.78    | -38.14 | -111.12  | -10.61 | -21.62   |        |
| 10.0   | -9.69  | 55.02    | 20.92  | 31.53    | -38.25 | -168.04  | -10.53 | -64.86   | 2.016  |
| 10.5   | -9.00  | 2.05     | 20.74  | -29.49   | -37.65 | 133.49   | -11.26 | -109.97  |        |
| 11.0   | -9.36  | -50.93   | 20.64  | -90.59   | -37.24 | 78.04    | -12.62 | -160.01  |        |
| 11.5   | -10.99 | -107.09  | 20.57  | -151.94  | -36.71 | 19.74    | -14.09 | 145.24   |        |
| 12.0   | -12.72 | -174.74  | 20.45  | 146.68   | -36.63 | -39.71   | -14.50 | 86.87    | 2.026  |
| 12.5   | -12.50 | 110.72   | 20.31  | 85.40    | -36.74 | -98.01   | -13.20 | 31.84    |        |
| 13.0   | -10.35 | 48.31    | 20.14  | 24.29    | -36.68 | -153.72  | -11.87 | -17.92   |        |
| 13.5   | -8.87  | -4.04    | 19.98  | -36.89   | -36.98 | 149.45   | -10.88 | -63.55   |        |
| 14.0   | -8.70  | -47.93   | 19.82  | -98.74   | -36.97 | 93.10    | -11.28 | -108.47  | 2.33   |
| 14.5   | -9.89  | -87.63   | 19.42  | -160.87  | -36.83 | 36.08    | -12.37 | -154.57  |        |
| 15.0   | -11.55 | -117.88  | 18.99  | 138.15   | -36.64 | -19.54   | -16.65 | 149.97   |        |
| 15.5   | -12.35 | -149.85  | 18.67  | 75.82    | -35.86 | -77.12   | -35.87 | 84.18    |        |
| 16.0   | -10.37 | 165.68   | 17.13  | 10.79    | -34.33 | -150.29  | -14.27 | -163.03  | 2.809  |
| 16.5   | -7.75  | 69.16    | 16.68  | -24.68   | -43.15 | 114.42   | -10.90 | 82.97    |        |
| 17.0   | -9.93  | 3.68     | 18.88  | -98.63   | -43.49 | 134.87   | -15.99 | 65.62    |        |
| 17.5   | -9.39  | -43.54   | 17.96  | -166.15  | -38.62 | 98.95    | -11.57 | 36.49    |        |
| 18.0   | -8.11  | -93.30   | 17.52  | 132.71   | -34.16 | 37.05    | -8.63  | -13.07   | 3.607  |
| 18.5   | -9.91  | -155.23  | 17.16  | 68.45    | -31.76 | -32.73   | -8.10  | -70.38   |        |
| 19.0   | -12.43 | 127.43   | 16.80  | 3.23     | -31.36 | -105.37  | -11.09 | -126.69  |        |
| 19.5   | -11.75 | 15.00    | 15.77  | -67.74   | -32.93 | -168.03  | -15.17 | -179.57  |        |
| 20.0   | -9.90  | -67.91   | 13.59  | -133.13  | -31.81 | 140.77   | -15.84 | 102.41   |        |

## Typical on wafer Measurements

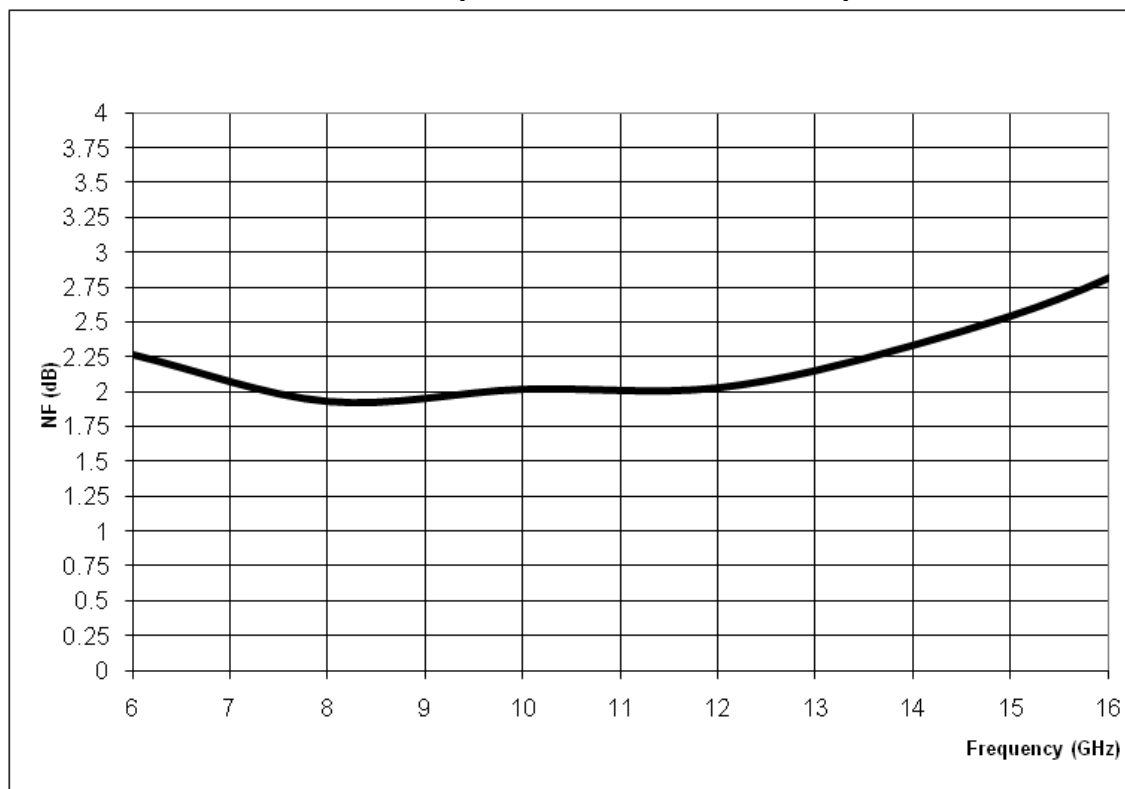
Temp = +25°C, Vd=4V (Id=80mA)

Measurements in the connector planes, using the proposed land pattern & board 96446.

Gain Losses & NF @Vd=4V



NF@Vd=4V (Test board losses included)

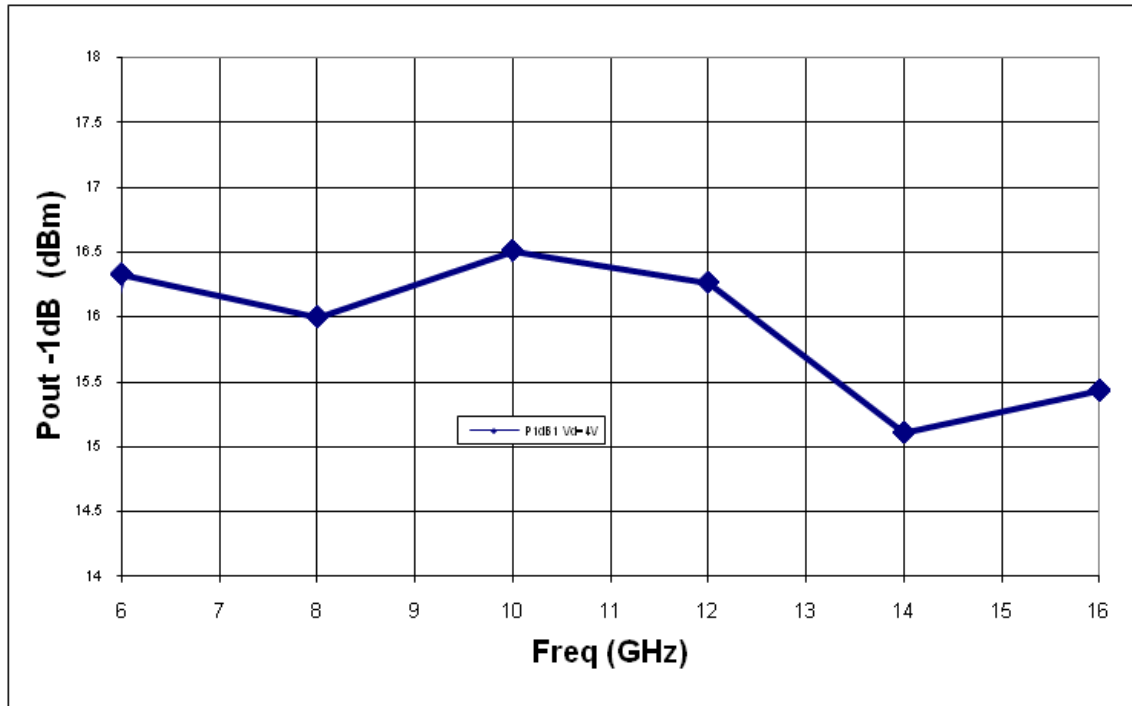


## Typical on wafer Measurements

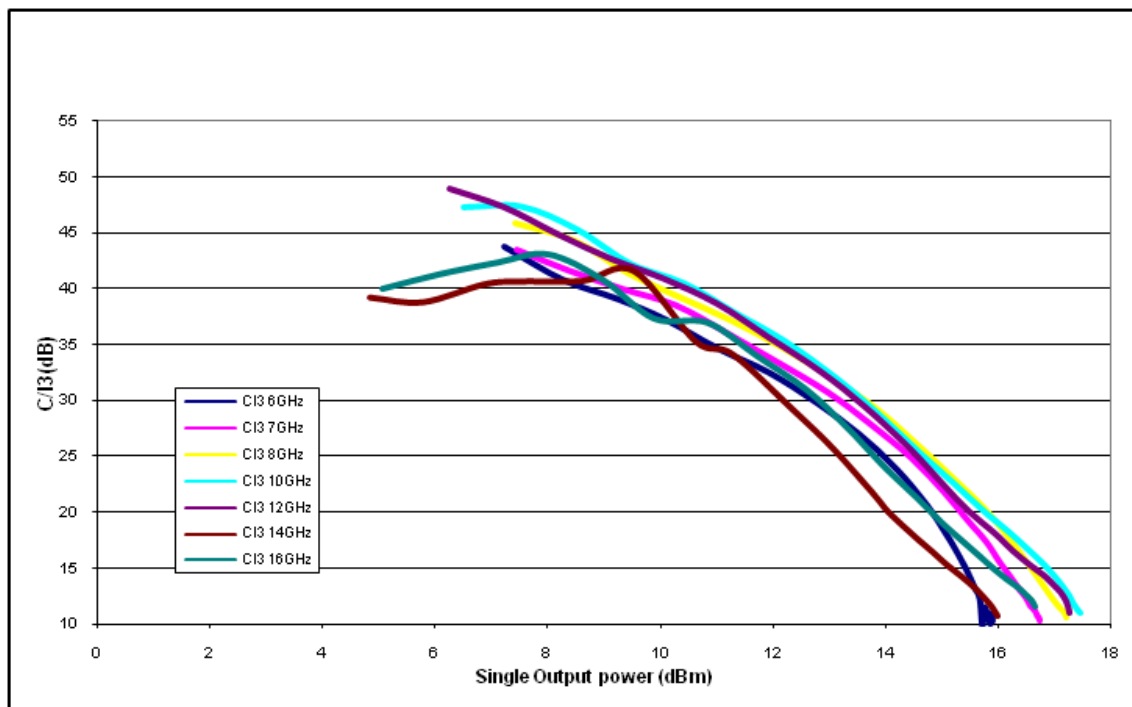
Temp = +25°C, Vd=4V (Id=80mA)

Measurements in the connector planes, using the proposed land pattern & board 96446.

Output power at 1dB compression versus frequency



C/I3 versus output power

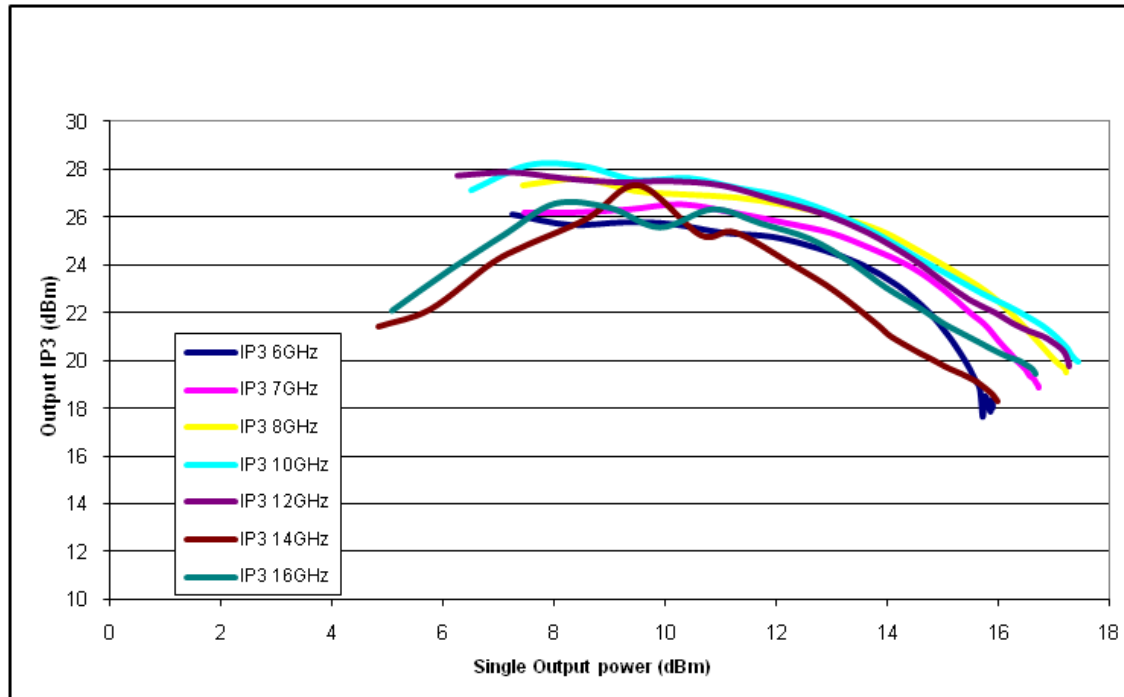


## Typical on wafer Measurements

Temp = +25°C, Vd=4V (Id=80mA)

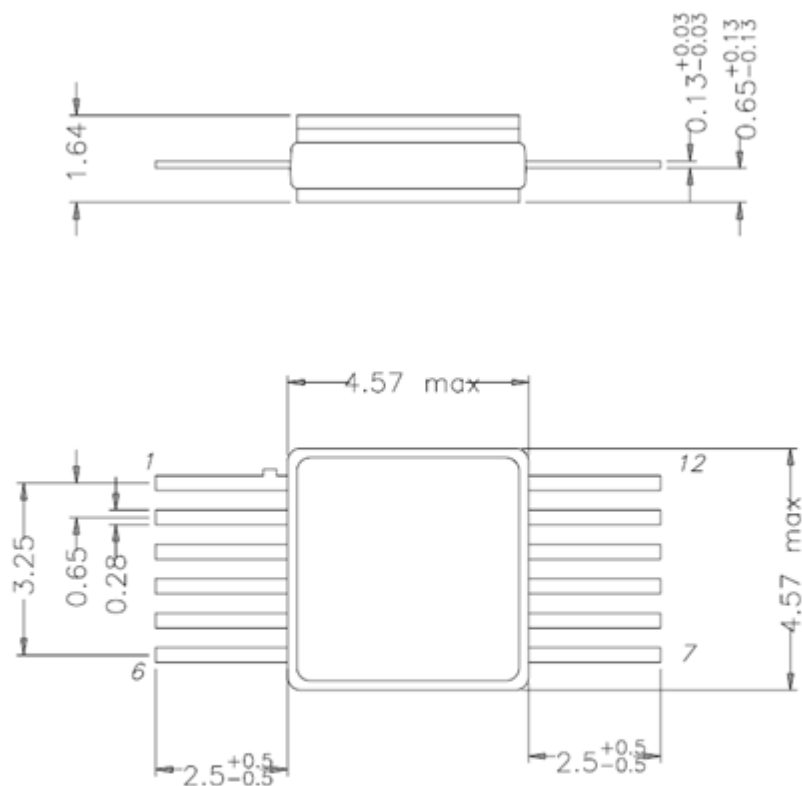
Measurements in the connector planes, using the proposed land pattern & board 96446.

Output IP3 versus output power



**Package outline <sup>(1)</sup>**

Units : mm

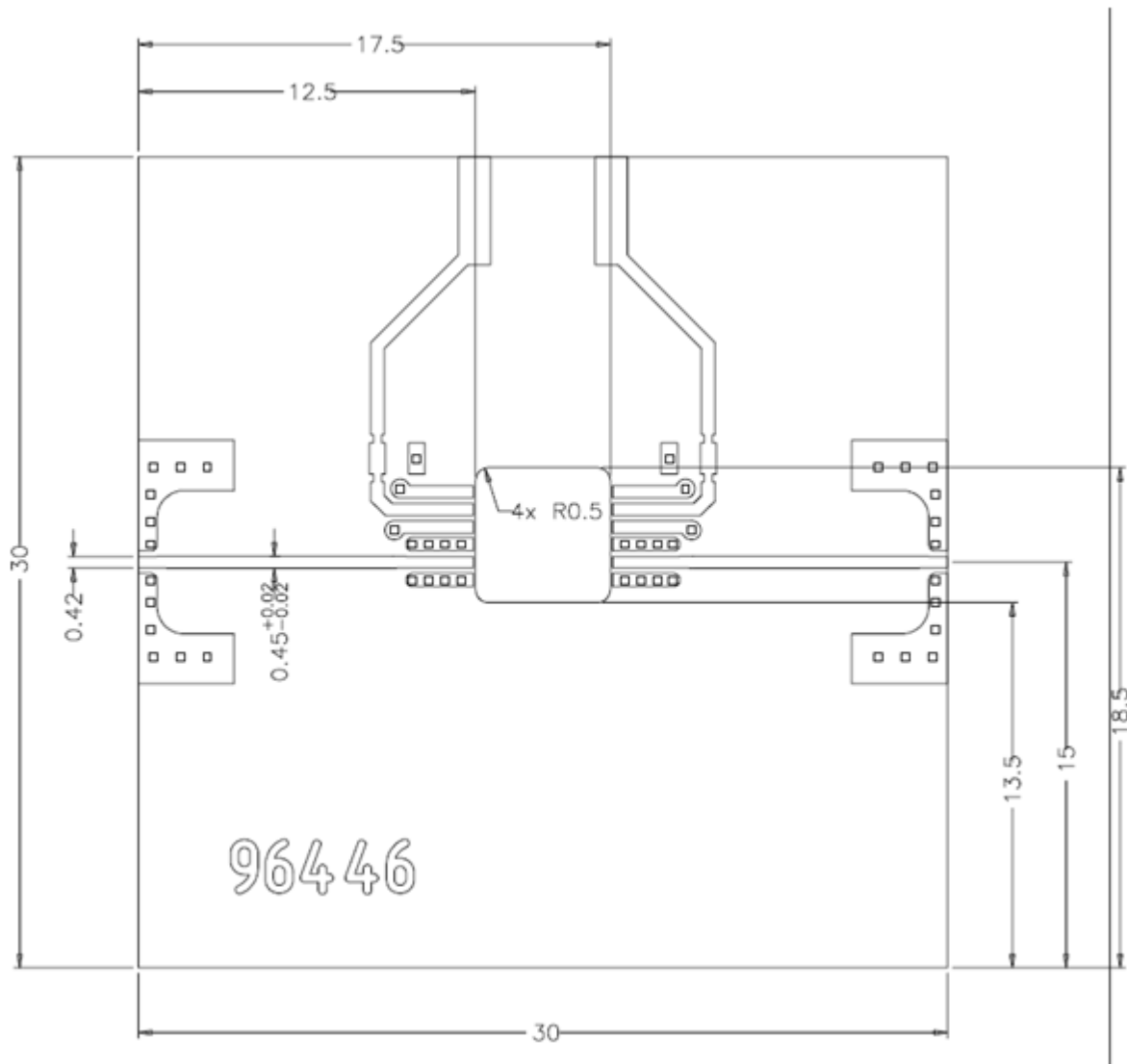


|    |         |    |       |     |         |
|----|---------|----|-------|-----|---------|
| 1- | Gnd     | 5- | RFin  | 9-  | Gnd     |
| 2- | VD1-VD2 | 6- | Gnd   | 10- | Gnd     |
| 3- | Gnd     | 7- | Gnd   | 11- | VD1-VD2 |
| 4- | Gnd     | 8- | RFout | 12- | Gnd     |

<sup>(1)</sup> Pin 2 and 11 should be chosen alternatively

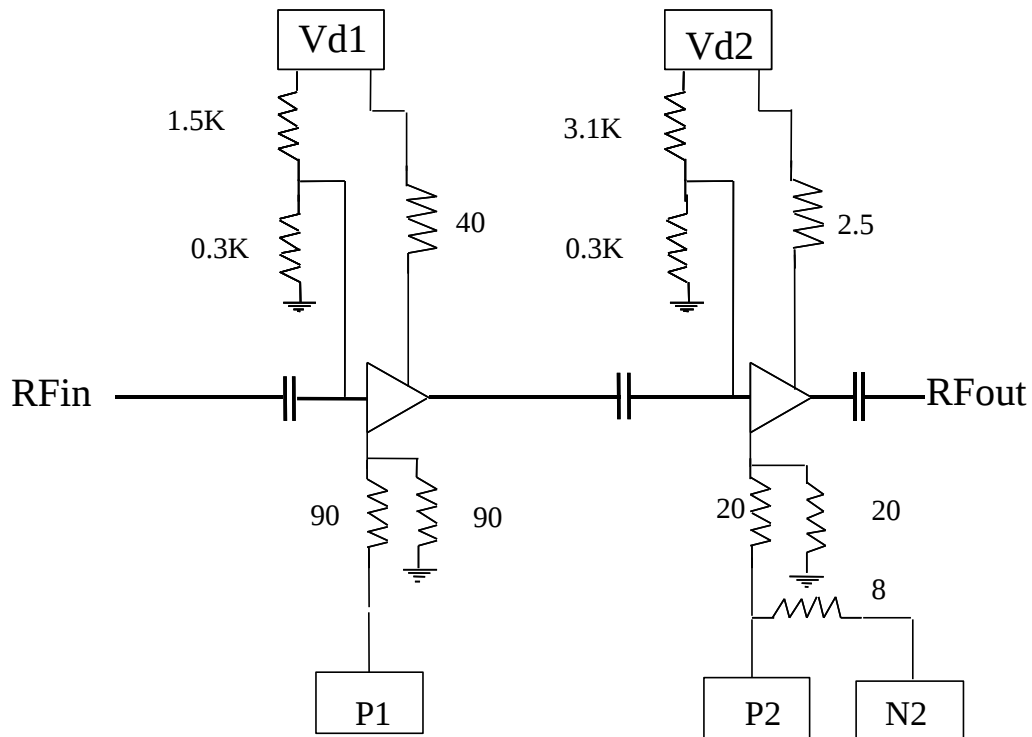
**Proposed Assembly board “96446” for the 12L-GlassMetal package products characterization**

- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Two biasing side options (pin 2 and 11)
- Decoupling capacitors of 10nF  $\pm 10\%$  are recommended for DC accesses.
- Recommended for the implementation of this product on a module board.



## DC Schematic

This chip is self-biased, and flexibility is provided by the access to number of leads. The internal DC electrical schematic is given in order to use these leads in a safe way.



Standard biasing:

Low Noise and low consumption:

$V_d = 4V$

$I_{dd} = 80mA$  &  $P_{out-1dB} = 16dBm$  Typical.

### Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACH N°1907/2006. More environmental data are available in the application note AN0019 also available at <http://www.ums-gaas.com>.

### Recommended ESD management

Refer to the application note AN0020 available at <http://www.ums-gaas.com> for ESD sensitivity and handling recommendations for the UMS package products.

### Ordering Information

Glass/Metal 12L hermetic package: CHA3666-SNF/XY  
Tray: XY = 20

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