

## 20-25GHz Low Noise Amplifier

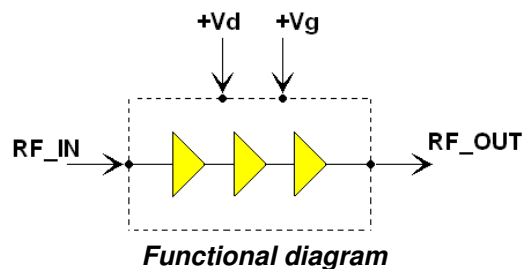
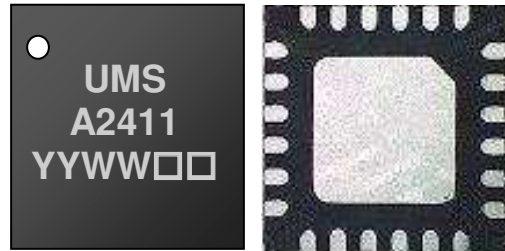
### GaAs Monolithic Microwave IC in SMD leadless package

#### Description

The CHA2411-QDG is a K-band low noise amplifier providing 26dB gain with a noise figure of 2.5dB from a single bias supply +5V.

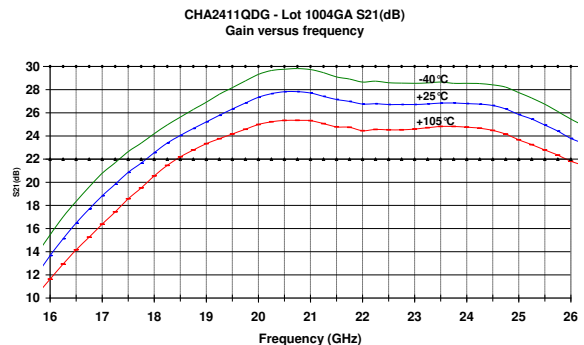
The circuit is manufactured with a pHEMT process, 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is supplied in RoHS compliant SMD package.



#### Main Features

- Broadband performances: 20-25GHz
- Excellent 2.5dB Noise figure
- 26dB ± 2dB stable Gain vs Temperature
- DC bias: Vd=5.0 Volt @ +I=43mA
- 24L-QFN4x4 SMD leadless package
- MSL1



#### Main Characteristics

Tamb.= +25°C

| Symbol | Parameter                     | Min | Typ | Max | Unit |
|--------|-------------------------------|-----|-----|-----|------|
| Fop    | Frequency range               | 20  |     | 25  | GHz  |
| G      | Linear Gain                   | 22  | 26  | 30  | dB   |
| NF     | Noise Figure                  |     | 2.5 |     | dB   |
| RLoss  | Input / Output Return Losses. |     | 15  |     | dB   |

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|------------------------|-------------------------------------|-----|-----------|-----|------|
| Fop                    | Frequency range                     | 20  |           | 25  | GHz  |
| G                      | Linear Gain                         | 22  | 26        | 30  | dB   |
| $\Delta G(\text{Fop})$ | Gain variation in frequency range   |     | $\pm 0.5$ |     | dB   |
| $\Delta G(\text{T})$   | Gain variation in temperature range |     | $\pm 2$   |     | dB   |
| NF                     | Noise figure                        |     | 2.5       |     | dB   |
| RLoss                  | Input / Output Return RLosses.      |     | -10       |     | dB   |
| $P_{-1\text{dB in}}$   | Input Power at 1dB Gain Comp @24GHz |     | -14       |     | dBm  |
| IP3 in                 | Input IP3 @24GHz                    |     | -7.5      |     | dBm  |
| Pout_sat               | Saturated Output Power @24GHz       |     | 13.5      | 15  | dBm  |
| +Vd, +Vg               | Supply Voltage                      |     | 5         |     | V    |
| +I                     | Supply Current                      |     | 43        | 55  | mA   |
| Top                    | Operating temperature range         | -40 | 25        | 105 | °C   |

These values are representative of onboard measurements as defined on the drawing in paragraph "Evaluation mother board".

These performances have been obtained with the chip in QFN package mounted on the recommended boards (reference 95541) described in this document. These performances are highly dependent on this environment.

## Absolute Maximum Ratings

Tamb.= +25°C<sup>(1)</sup>

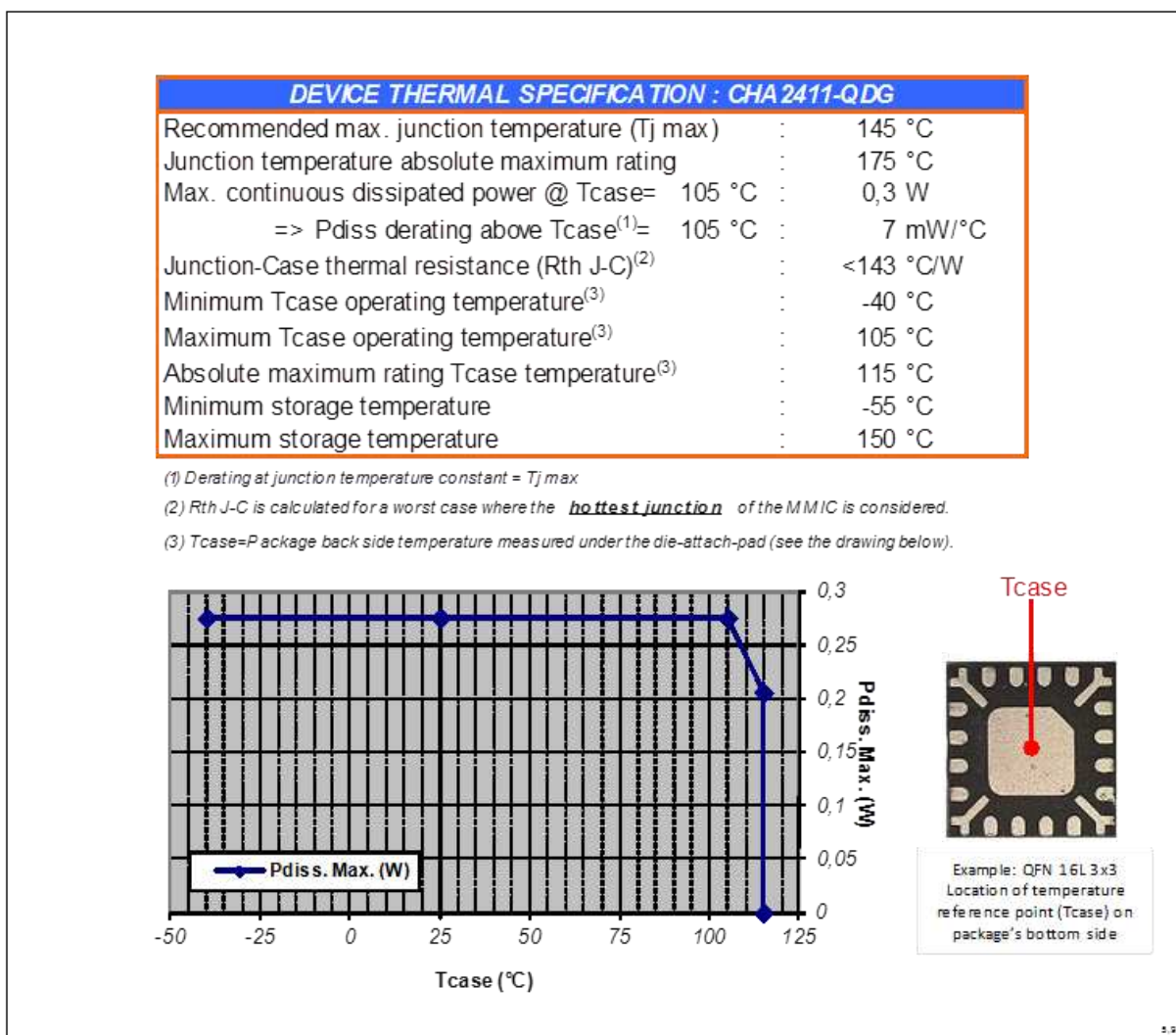
| Symbol   | Parameter                          | Values      | Unit |
|----------|------------------------------------|-------------|------|
| +Vg, +Vd | Maximum positive supply voltage    | 6V          | V    |
| +I       | Maximum positive supply current    | 65          | mA   |
| Pin      | Maximum peak input power overdrive | -5          | dBm  |
| Top      | Operating temperature range        | -40 to +105 | °C   |
| Tstg     | Storage temperature range          | -55 to +150 | °C   |

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

## Device thermal performances

All the figures given in this section are obtained assuming that the QFN device is cooled down only by conduction through the package thermal pad (no convection mode considered). The temperature is monitored at the package back-side interface ( $T_{case}$ ) as shown below. The system maximum temperature must be adjusted in order to guarantee that  $T_{case}$  remains below the maximum value specified in the next table. So, the PCB system must be designed to comply with this requirement.

A derating must be applied on the dissipated power if the  $T_{case}$  temperature cannot be maintained below the maximum temperature specified (see the curve  $P_{diss. Max.}$ ) in order to guarantee the nominal device life time (MTTF).

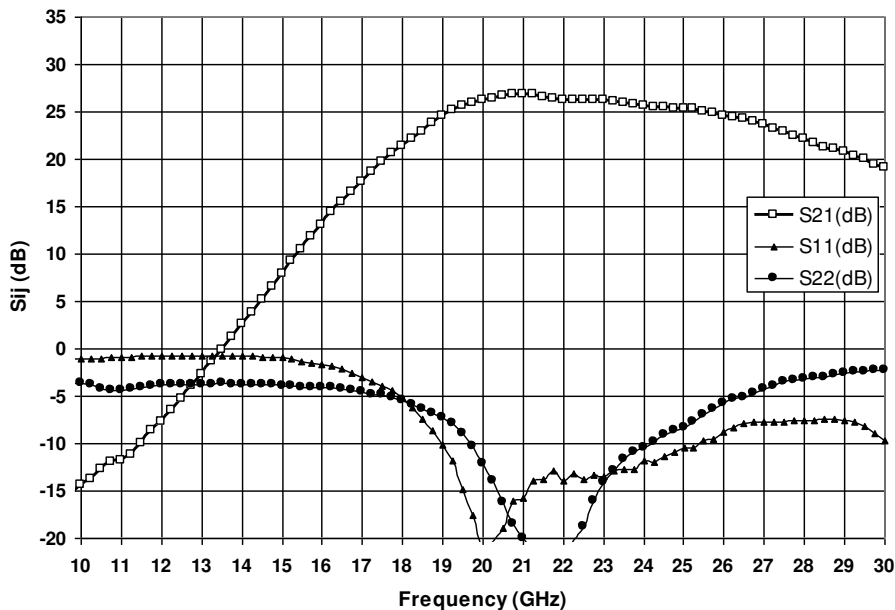


**Typical Package Sij parameters**

Tamb.= +25°C, Vd = +4.5V, Id = 43mA

| Freq (GHz) | S11 (dB) | PhS11 (°) | S12 (dB) | PhS12 (°) | S21 (dB) | PhS21 (°) | S22 (dB) | PhS22 (°) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 10.0       | -1.07    | -49.55    | -14.38   | -58.07    | -59.27   | -175.76   | -3.68    | -21.83    |
| 11.0       | -0.91    | -68.36    | -55.9    | -102.44   | -11.75   | 148.54    | -4.36    | -36.48    |
| 12.0       | -0.78    | -87.98    | -54.01   | -148.74   | -7.68    | 126.87    | -3.85    | -53.87    |
| 13.0       | -0.73    | -107.81   | -49.64   | 178.55    | -2.72    | 98.18     | -3.72    | -73.42    |
| 14.0       | -0.74    | -128.9    | -46.02   | 139.21    | 2.54     | 64.31     | -3.71    | -93.32    |
| 15.0       | -0.98    | -151.4    | -46.54   | 107.66    | 7.85     | 24.67     | -3.92    | -113.67   |
| 16.0       | -1.61    | -176.03   | -42.24   | 89.48     | 13.10    | -21.61    | -4.10    | -133.26   |
| 17.0       | -3.00    | 156.34    | -42.85   | 34.58     | 17.64    | -74.45    | -4.56    | -154.71   |
| 18.0       | -5.18    | 123.53    | -45.15   | 17.88     | 21.34    | -132.27   | -5.50    | -179.79   |
| 19.0       | -10.11   | 84.87     | -50.38   | -17.51    | 24.50    | 168.46    | -7.22    | 152.98    |
| 20.0       | -21.11   | -6.32     | -52.53   | -49.82    | 26.22    | 104.07    | -12.06   | 111.32    |
| 21.0       | -15.70   | -136.32   | -55.01   | 127.63    | 26.76    | 42.30     | -19.95   | 67.22     |
| 22.0       | -13.98   | -172.06   | -47.39   | 77.30     | 26.20    | -13.39    | -21.91   | -57.46    |
| 23.0       | -13.50   | -179.07   | -64.30   | -43.79    | 26.17    | -64.30    | -14.09   | -87.97    |
| 24.0       | -11.79   | 175.47    | -41.92   | 19.85     | 25.62    | -115.15   | -10.50   | -118.95   |
| 25.0       | -10.43   | 165.19    | -42.35   | 4.31      | 25.27    | -163.45   | -8.33    | -136.39   |
| 26.0       | -8.74    | 154.28    | -41.19   | -6.44     | 24.56    | 146.28    | -5.78    | -152.57   |
| 27.0       | -7.78    | 131.33    | -41.32   | -17.81    | 23.64    | 96.46     | -4.30    | -170.04   |
| 28.0       | -7.62    | 113.23    | -39.65   | -29.56    | 22.06    | 49.94     | -3.15    | 170.66    |
| 29.0       | -7.60    | 91.53     | -38.35   | -57.29    | 20.70    | 7.00      | -2.55    | 155.07    |
| 30.0       | -9.76    | 62.59     | -39.18   | -83.28    | 19.04    | -39.18    | -2.26    | 137.12    |

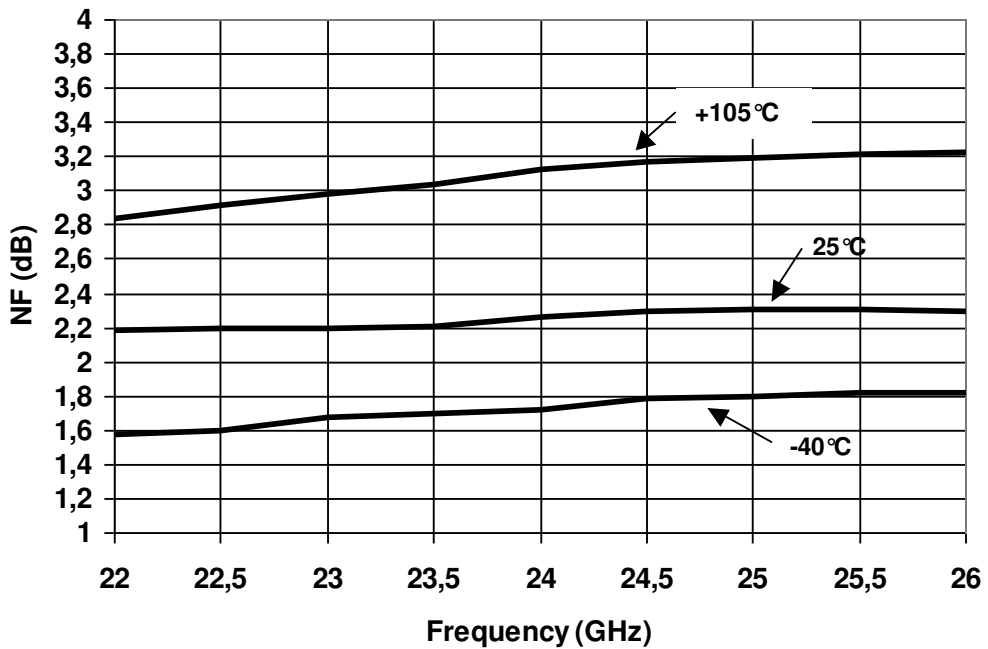
Typical Sij Parameters versus Frequency in the QFN package plans



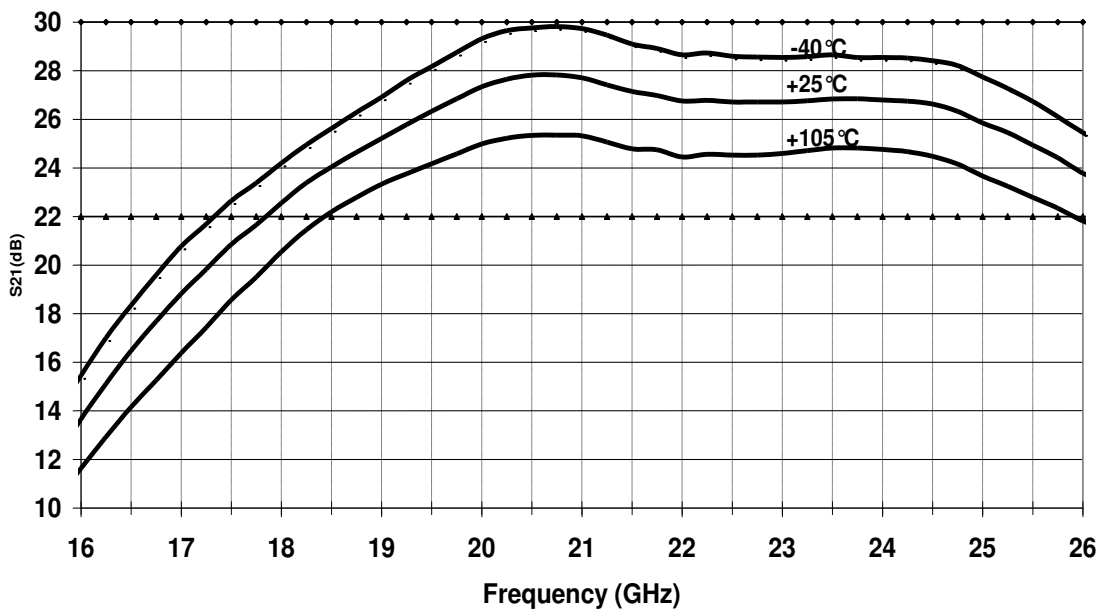
**Typical Measurements on board 95541 (QFN plan)**

Tamb.= -40°; +25°C; +105°C ,Vd = +4.5V / 55mA max

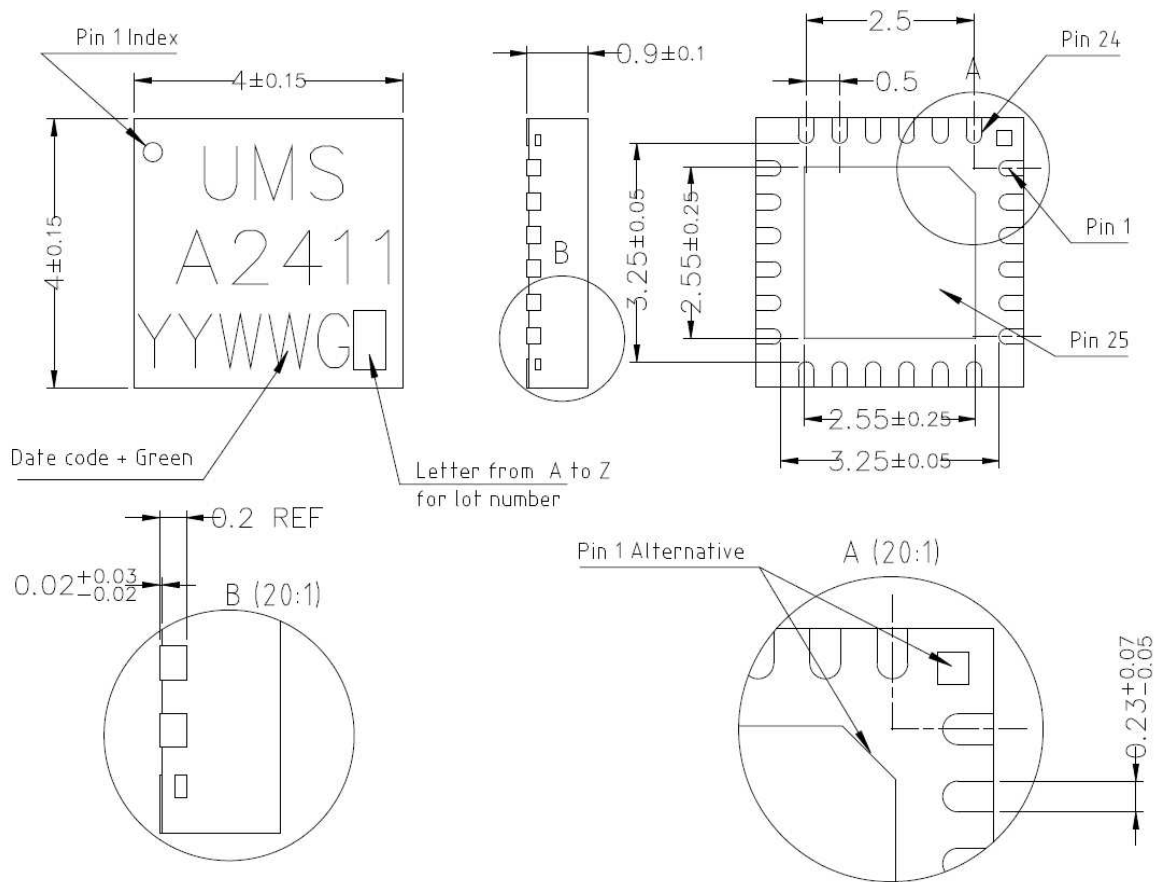
**Noise Figure versus Frequency**



**Linear Gain versus Frequency**



Package outline

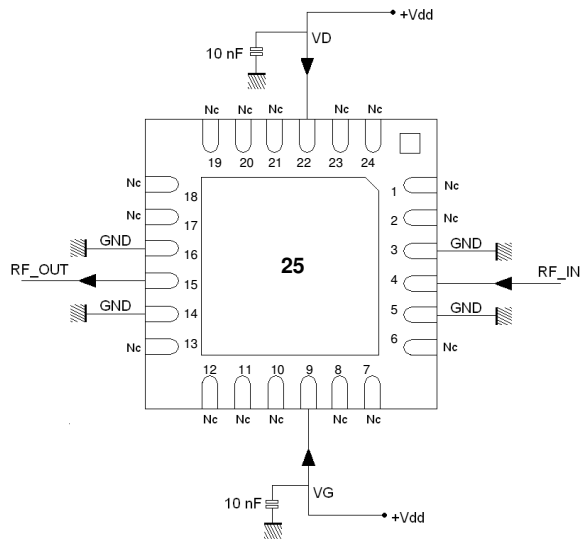


|                     |              |                       |                        |
|---------------------|--------------|-----------------------|------------------------|
| Matt tin, Lead Free | (Green)      | 1- Nc                 | 13- Nc                 |
| Units :             | mm           | 2- Nc                 | 14- Gnd <sup>(2)</sup> |
| From the standard : | JEDEC MO-220 | 3- Gnd <sup>(2)</sup> | 15- RF_OUT             |
|                     | (VGGD)       | 4- RF_IN              | 16- Gnd <sup>(2)</sup> |
|                     | 25- GND      | 5- Gnd <sup>(2)</sup> | 17- Nc                 |
|                     |              | 6- Nc                 | 18- Nc                 |
|                     |              | 7- Nc                 | 19- Nc                 |
|                     |              | 8- Nc                 | 20- Nc                 |
|                     |              | 9- VG                 | 21- Nc                 |
|                     |              | 10- Nc                | 22- VD                 |
|                     |              | 11- Nc                | 23- Nc                 |
|                     |              | 12- Nc                | 24- Nc                 |

(1) The package outline drawing included to this data-sheet is given for indication. Refer to the application note AN0017 (<http://www.ums-gaas.com>) for exact package dimensions.

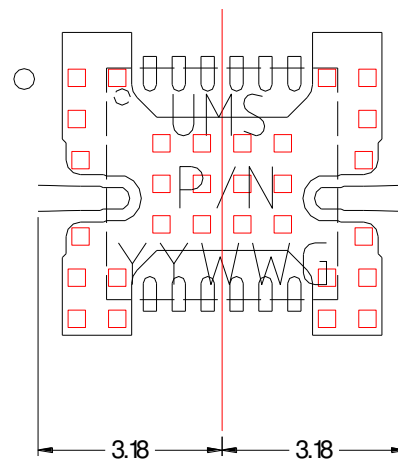
(2) It is strongly recommended to ground all pins marked "Gnd" through the PCB board. Ensure that the PCB board is designed to provide the best possible ground to the package.

**External Components and bias configuration (recommended)**



**Definition of the Sij reference planes**

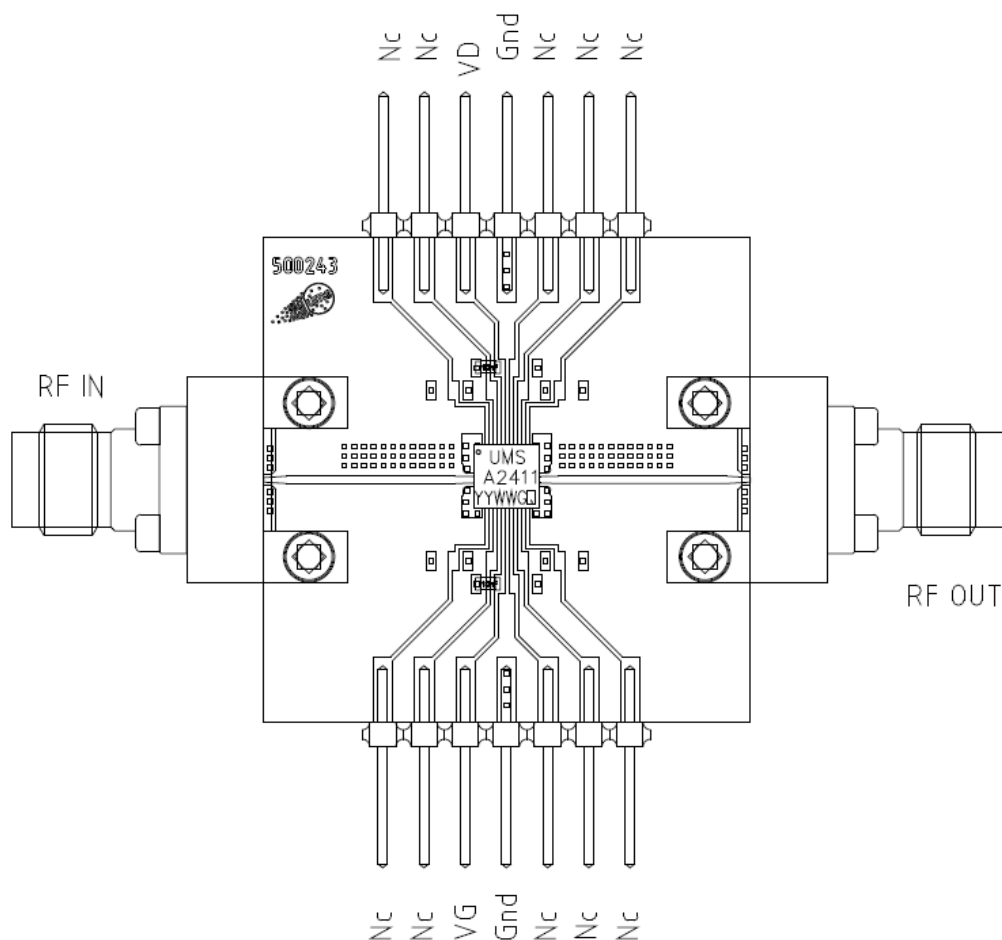
The reference planes used for Sij measurements given above are symmetrical from the symmetrical axis of the package (see drawing beside). The input and output reference planes are located at 3.18mm offset (input wise and output wise respectively) from this axis. Then, the given Sij parameters incorporate the land pattern of the evaluation motherboard recommended in paragraph "Evaluation motherboard".



## Evaluation mother board

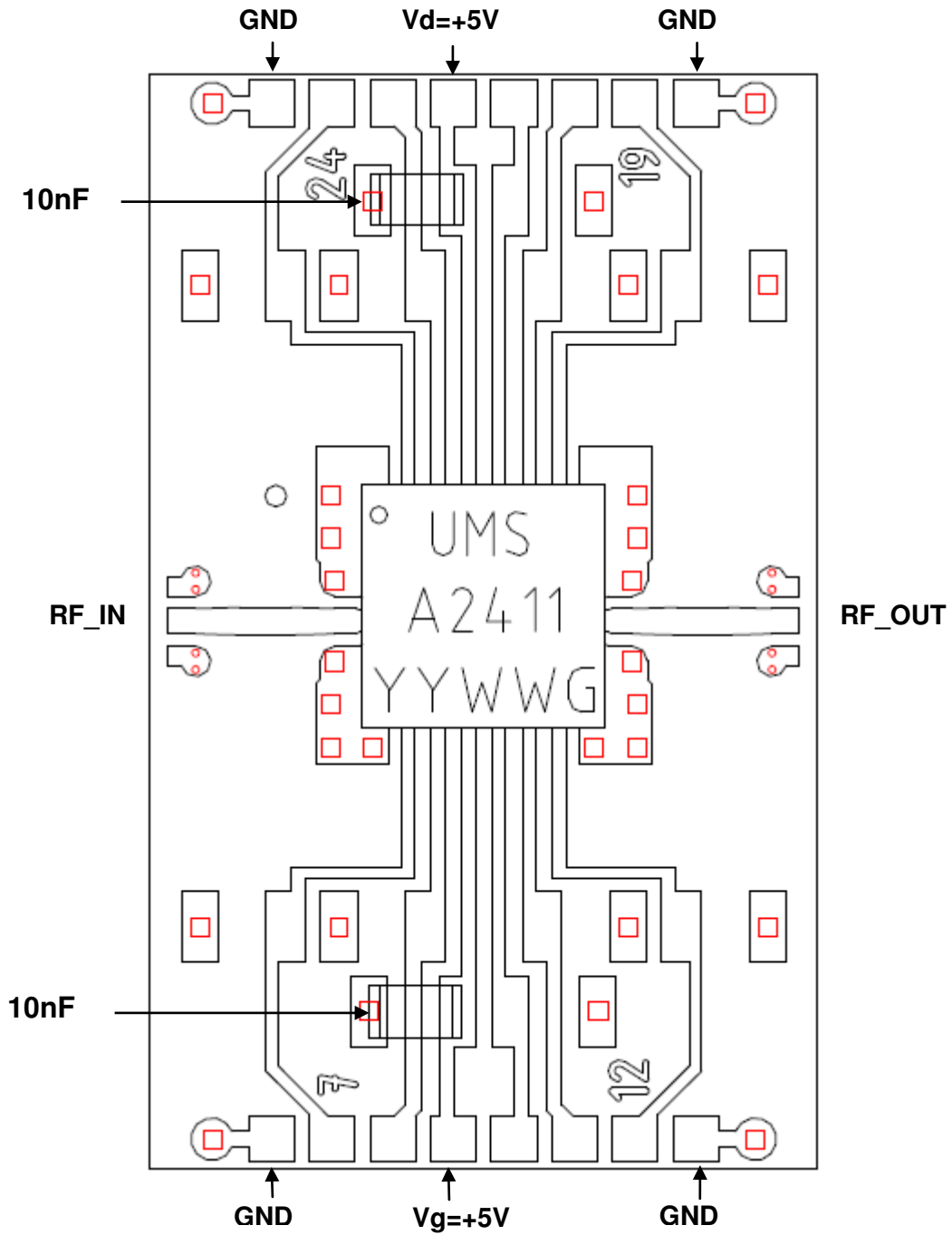
- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Using a micro-strip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.
- Decoupling capacitors of 10nF  $\pm$ 10% are recommended for all DC accesses.
- See application note AN0017 for details.

## Recommended Test fixture (Ref. 500243) for measurements over temperature range



**Evaluation mother board**

Recommended Test fixture (Ref. 95541) for measurements over temperature range (unit=mm)



## Recommended package footprint

Refer to the application note AN0017 available at <http://www.ums-gaas.com> for package footprint recommendations.

## SMD mounting procedure

For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0017.

## 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

QFN4x4 RoHS compliant package:

CHA2411-QDG/XY

Stick: XY = 20

Tape & reel: XY = 21

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