

# 7-16GHz High Power Amplifier *Preliminary*

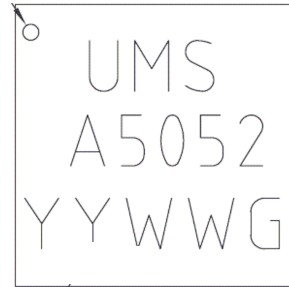
## GaAs Monolithic Microwave IC in SMD package

### Description

The CHA5052-QGG is a three-stage monolithic high power amplifier.

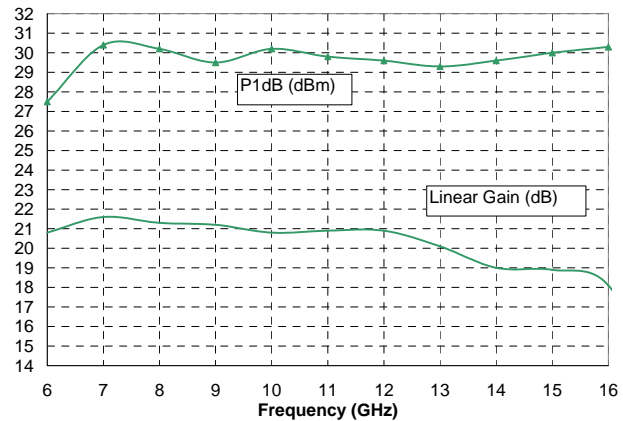
The circuit is manufactured with a power PHEMT process, 0.15µm gate length, via holes through the substrate.

It is supplied in RoHS compliant SMD package.



### Main Features

- Frequency range 7-16GHz
- Gain: 19dB
- 37dBm 3<sup>rd</sup> order intercept point
- 29dBm Output Power @1dB compression
- ESD protected (see page 7)
- DC power consumption, 700mA @ 5V
- 28LQFN5x5



Typical on board measurements

### Main Characteristics

Tamb. = 25°C, Vd = 5V

| Symbol | Parameter                            | Min | Typ | Max | Unit |
|--------|--------------------------------------|-----|-----|-----|------|
| Fop    | Operating frequency range            | 7   |     | 16  | GHz  |
| G_lin  | Small signal gain                    |     | 19  |     | dB   |
| P1dB   | Output power at 1dB gain compression |     | 29  |     | dBm  |
| OIP3   | Output IP3                           |     | 37  |     | dBm  |

ESD Protection: Electrostatic discharge sensitive device. Observe handling precautions!

**Electrical Characteristics**

Tamb=25°C, Vd = 5V and Id = 700mA, CW biasing mode.

These values are representative of onboard measurements as defined on the drawing 96402

*Preliminary*

| Symbol   | Parameter                          | Min | Typ   | Max | Unit |
|----------|------------------------------------|-----|-------|-----|------|
| Fop      | Operating frequency range          | 7   |       | 16  | GHz  |
| G_lin    | Small signal gain from 7 to 12GHz  |     | 20    |     | dB   |
|          | from 12.5 to 16GHz                 |     | 18    |     | dB   |
| P1dB     | Output power at 1dB compression    |     | 29    |     | dBm  |
| Psat     | Saturated output power             |     | 30    |     | dBm  |
| IS11I    | Input return loss                  |     | 1.4:1 |     |      |
| IS22I    | Output return loss                 |     | 2.0:1 |     |      |
| OIP3     | Output IP3 from 7 to 8GHz          |     | 38    |     | dBm  |
|          | from 9 to 16GHz                    |     | 36    |     | dBm  |
| Vg       | Negative gate bias voltage         |     | -1.7  |     | V    |
| Vd 1,2,3 | Positive drain bias voltage        |     | 5     |     | V    |
| Id       | Power supply quiescent current (1) |     | 700   |     | mA   |

(1) This value is fixed by gate voltage Vg

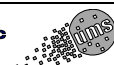
**Absolute Maximum Ratings**

Tamb. = 25°C (1)

| Symbol | Parameter                       | Values      | Unit |
|--------|---------------------------------|-------------|------|
| Vd     | Maximum Drain bias voltage      | +5.5        | V    |
| Id     | Power supply quiescent current  | 800         | mA   |
| Vg     | Gate bias voltage               | -4 to +0.8  | V    |
| Pin    | Maximum input power overdrive   | +13.0       | dBm  |
| Tj     | Maximum channel temperature (2) | +175        | °C   |
| Top    | Operating temperature range     | -40 to +80  | °C   |
| Tstg   | Storage temperature range       | -55 to +125 | °C   |

(1) Operation of this device above any of these parameters may cause permanent damage.

(2) Thermal Resistance channel to ground paddle =26.9°C/W for Tpaddle. = +80°C



# 7-16GHz High Power Amplifier

CHA5052-QGG

*Preliminary*

## Typical Package Sij parameters

Tamb = +25°C, Vd1=Vd2=Vd3= +4.5V, Id = 700 mA

| Freq (GHz) | dB (S11) | P (S11) (°) | dB (S21) | P (S21) (°) | dB (S12) | P (S12) (°) | dB (S22) | P (S22) (°) |
|------------|----------|-------------|----------|-------------|----------|-------------|----------|-------------|
| 0,5        | -1,9     | 152         | -44,6    | 27          | -62,4    | -29         | -1,7     | 149         |
| 1,0        | -2,9     | 126         | -48,8    | -29         | -84,2    | -119        | -1,5     | 118         |
| 1,5        | -4,1     | 104         | -47,8    | -137        | -71,5    | -21         | -1,5     | 88          |
| 2,0        | -5,6     | 84          | -35,0    | 78          | -71,5    | -112        | -1,5     | 57          |
| 2,5        | -7,1     | 64          | -46,5    | 55          | -71,6    | 111         | -1,3     | 27          |
| 3,0        | -8,5     | 47          | -18,6    | 47          | -83,1    | -62         | -1,2     | -4          |
| 3,5        | -9,9     | 29          | -13,5    | -17         | -70,9    | 156         | -1,2     | -35         |
| 4,0        | -11,4    | 12          | -5,1     | -34         | -68,5    | 43          | -1,4     | -68         |
| 4,5        | -12,9    | -6          | 6,3      | -95         | -81,3    | -119        | -2,0     | -104        |
| 5,0        | -14,3    | -24         | 14,0     | -175        | -65,3    | 83          | -3,8     | -143        |
| 5,5        | -15,8    | -42         | 18,3     | 103         | -69,6    | 27          | -7,9     | -180        |
| 6,0        | -17,5    | -62         | 20,6     | 26          | -69,2    | 94          | -14,7    | 161         |
| 6,5        | -19,8    | -83         | 21,7     | -43         | -62,8    | 40          | -18,8    | -179        |
| 7,0        | -22,7    | -107        | 22,2     | -107        | -66,2    | 3           | -18,0    | -173        |
| 7,5        | -27,2    | -137        | 22,3     | -166        | -67,8    | 28          | -17,9    | 177         |
| 8,0        | -33,5    | 157         | 22,1     | 137         | -62,3    | -5          | -18,8    | 164         |
| 8,5        | -28,9    | 62          | 21,8     | 84          | -67,4    | -54         | -20,6    | 149         |
| 9,0        | -23,6    | 20          | 21,5     | 33          | -69,0    | -60         | -23,9    | 141         |
| 9,5        | -20,5    | -9          | 21,3     | -16         | -59,5    | -77         | -30,3    | 156         |
| 10,0       | -18,7    | -33         | 21,2     | -66         | -62,1    | -129        | -28,2    | -141        |
| 10,5       | -18,8    | -60         | 21,1     | -115        | -67,5    | -153        | -20,6    | -146        |
| 11,0       | -18,5    | -83         | 21,0     | -163        | -58,0    | -166        | -16,9    | -159        |
| 11,5       | -18,1    | -106        | 21,0     | 147         | -59,2    | 162         | -14,0    | -175        |
| 12,0       | -18,1    | -125        | 20,9     | 96          | -58,0    | 142         | -12,8    | 168         |
| 12,5       | -18,7    | -143        | 20,6     | 45          | -58,0    | 112         | -12,7    | 148         |
| 13,0       | -19,6    | -158        | 20,2     | -6          | -57,9    | 81          | -14,5    | 135         |
| 13,5       | -20,8    | -170        | 19,9     | -60         | -61,1    | 143         | -13,5    | 135         |
| 14,0       | -21,2    | 172         | 19,1     | -114        | -56,6    | 95          | -12,1    | 121         |
| 14,5       | -24,0    | 155         | 18,7     | -167        | -56,7    | 81          | -10,7    | 102         |
| 15,0       | -31,6    | 137         | 18,4     | 138         | -56,1    | 92          | -10,2    | 71          |
| 15,5       | -40,9    | -78         | 18,5     | 77          | -52,6    | 80          | -10,1    | 30          |
| 16,0       | -24,2    | -96         | 18,3     | 7           | -52,7    | 54          | -10,0    | -22         |
| 16,5       | -19,2    | -126        | 16,8     | -73         | -51,9    | 50          | -10,1    | -86         |
| 17,0       | -17,2    | -148        | 12,8     | -155        | -49,1    | 12          | -10,9    | -139        |
| 17,5       | -16,4    | -175        | 7,2      | 130         | -61,8    | 22          | -12,5    | -168        |
| 18,0       | -16,7    | 161         | 0,8      | 60          | -55,8    | 56          | -11,4    | -167        |
| 18,5       | -17,8    | 138         | -6,3     | -4          | -50,4    | 29          | -6,9     | 174         |
| 19,0       | -19,3    | 118         | -14,4    | -62         | -52,2    | 12          | -4,0     | 143         |
| 19,5       | -21,1    | 92          | -23,3    | -111        | -50,3    | 2           | -2,6     | 112         |
| 20,0       | -22,5    | 60          | -33,7    | -151        | -49,7    | 1           | -1,9     | 83          |
| 20,5       | -22,7    | 27          | -49,8    | -152        | -49,9    | -23         | -1,6     | 58          |
| 21,0       | -21,7    | -6          | -49,2    | -121        | -54,0    | -32         | -1,4     | 35          |
| 21,5       | -19,8    | -34         | -57,5    | -144        | -57,8    | -4          | -1,3     | 14          |
| 22,0       | -17,9    | -54         | -48,3    | -122        | -51,6    | 7           | -1,2     | -6          |
| 22,5       | -16,3    | -70         | -56,6    | 100         | -50,2    | -7          | -1,1     | -24         |
| 23,0       | -15,1    | -84         | -54,6    | 86          | -51,1    | -19         | -1,0     | -41         |
| 23,5       | -14,0    | -95         | -4,3     | 48          | -49,5    | 7           | -0,9     | -57         |
| 24,0       | -12,9    | -105        | -42,4    | 19          | -46,9    | -9          | -0,9     | -72         |
| 24,5       | -11,9    | -116        | -39,3    | -11         | -45,5    | -15         | -87,2    | -85         |
| 25,0       | -11,0    | -128        | -41,2    | -35         | -43,9    | -30         | -79,4    | -97         |
| 25,5       | -10,5    | -143        | -44,1    | -62         | -44,8    | -33         | -76,4    | -109        |
| 26,0       | -11,4    | -158        | -40,9    | -50         | -42,2    | -39         | -79,8    | -121        |
| 26,5       | -14,1    | -161        | -41,3    | -74         | -41,5    | -53         | -75,6    | -131        |
| 27,0       | -14,0    | -143        | -47,5    | -71         | -42,1    | -62         | -73,6    | -141        |
| 27,5       | -11,4    | -141        | -42,8    | -86         | -41,6    | -63         | -69,0    | -151        |
| 28,0       | -9,5     | -148        | -42,0    | -77         | -39,0    | -71         | -65,7    | -161        |
| 28,5       | -8,4     | -156        | -38,9    | -94         | -37,9    | -89         | -65,3    | -170        |
| 29,0       | -7,5     | -165        | -36,4    | -95         | -37,8    | -104        | -77,5    | -178        |
| 29,5       | -6,9     | -174        | -3,6     | -105        | -37,2    | -115        | -90,4    | 173         |
| 30,0       | -6,5     | 177         | -36,7    | -119        | -36,6    | -127        | -0,9     | 164         |

Refer to the “definition of the Sij reference planes” section below

Ref: DSCHA5052QGG7033 - 02 Feb 07

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/Specifications subject to change without notice

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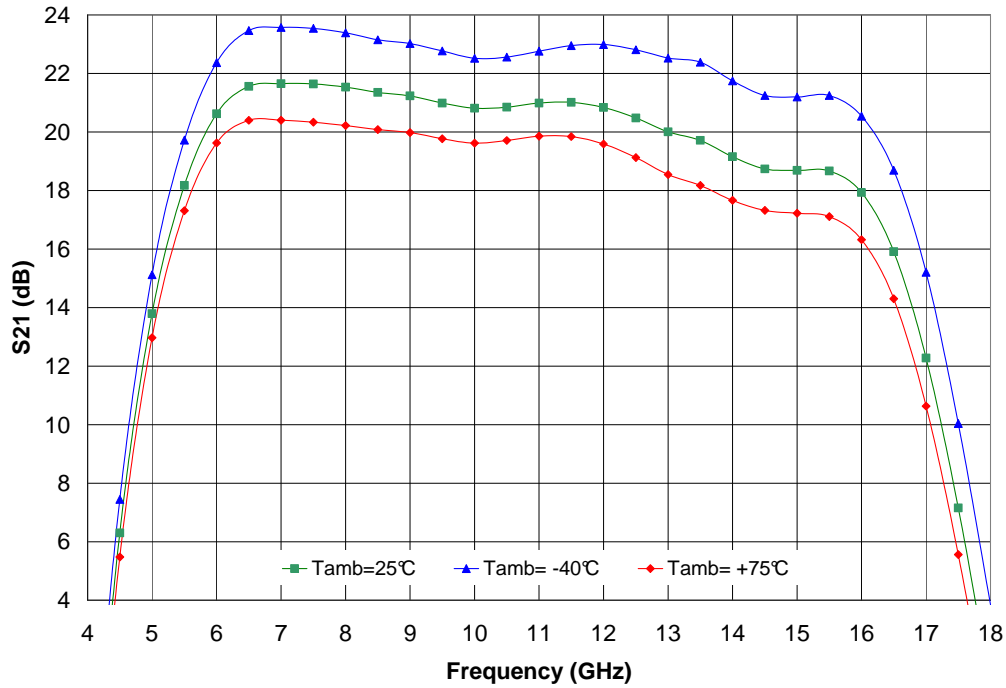
Typical Measured Performance

Tamb = +25°C, Vd1=Vd2=Vd3=+5V, Id (Quiescent)=700mA , CW biasing mode

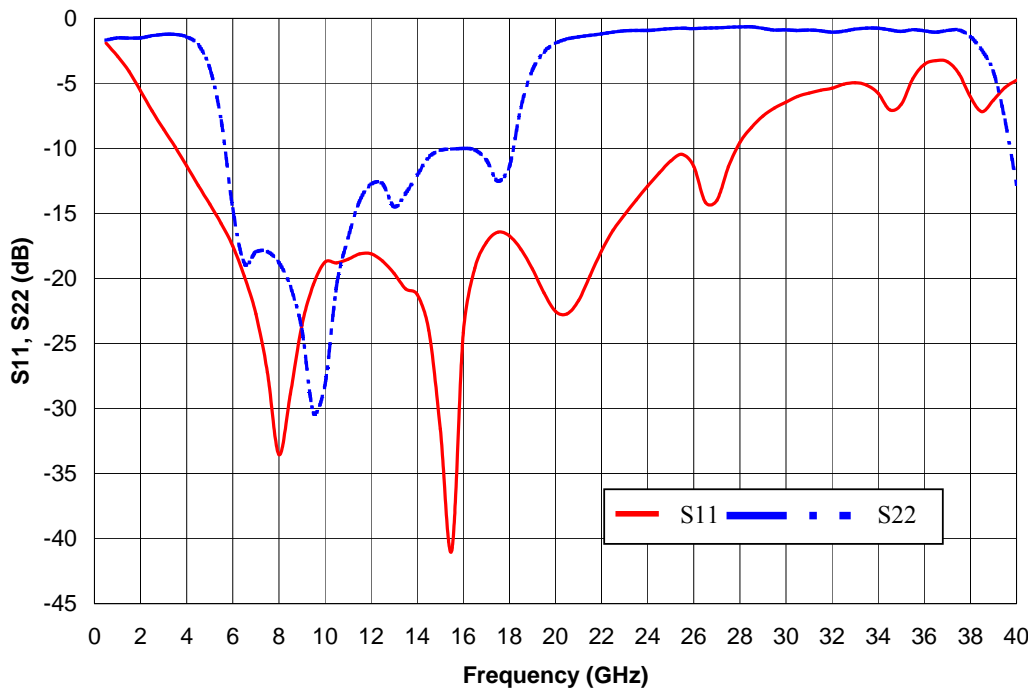
*Preliminary*

Measurements in the package access planes, using the proposed land pattern & board 96402

Gain variation versus temperature

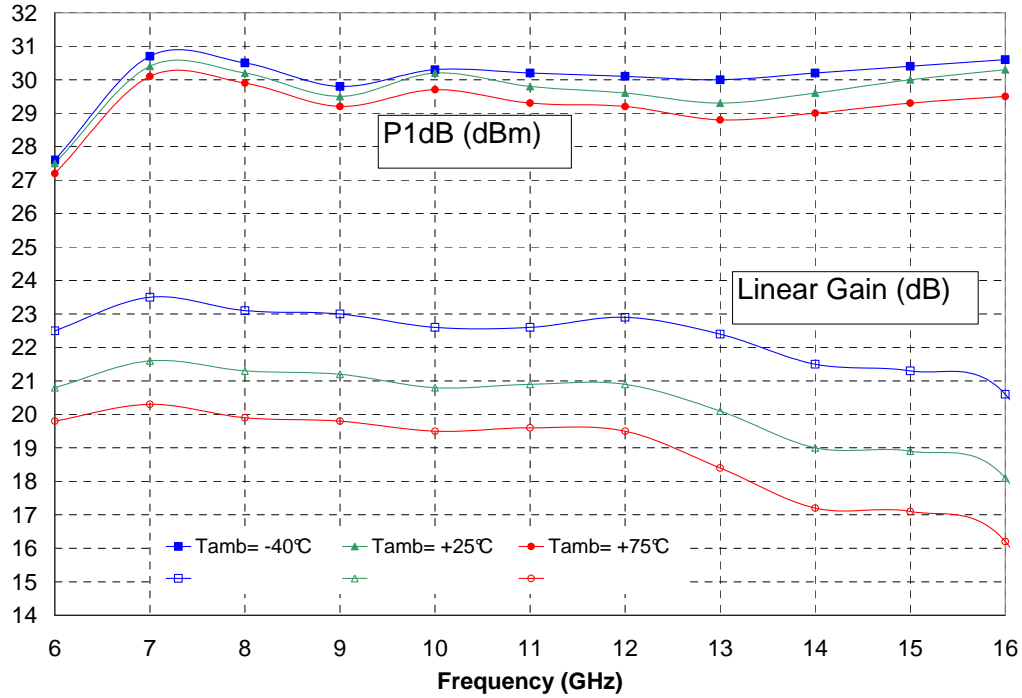


Return losses versus temperature @ 25°C

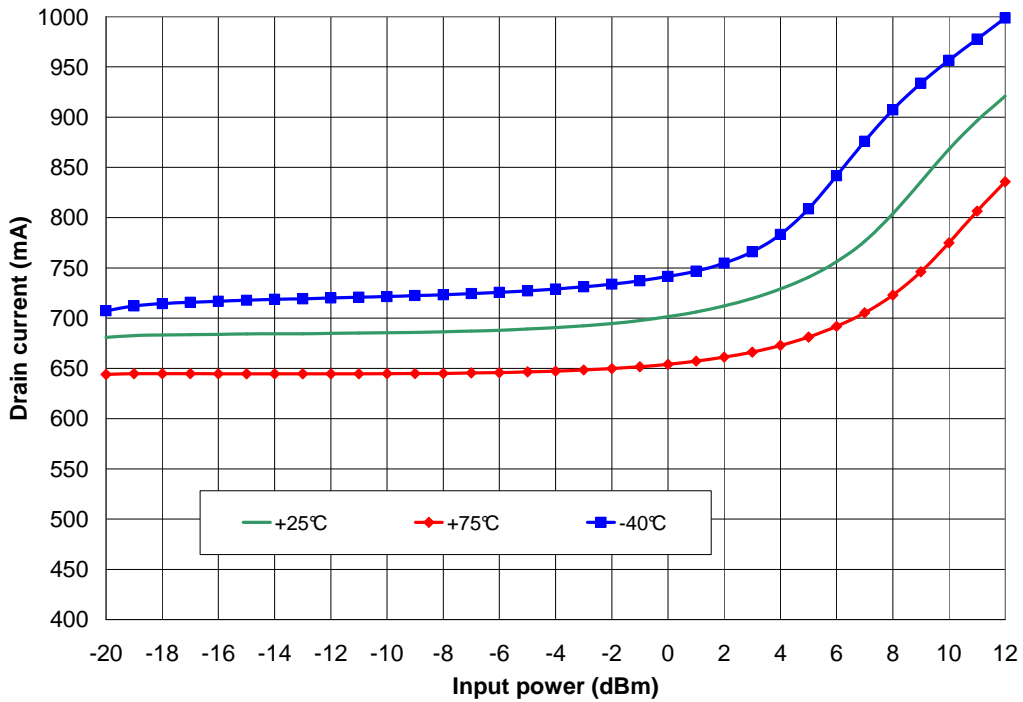


*Preliminary*

Output power@ 1dB compression & linear Gain versus temperature

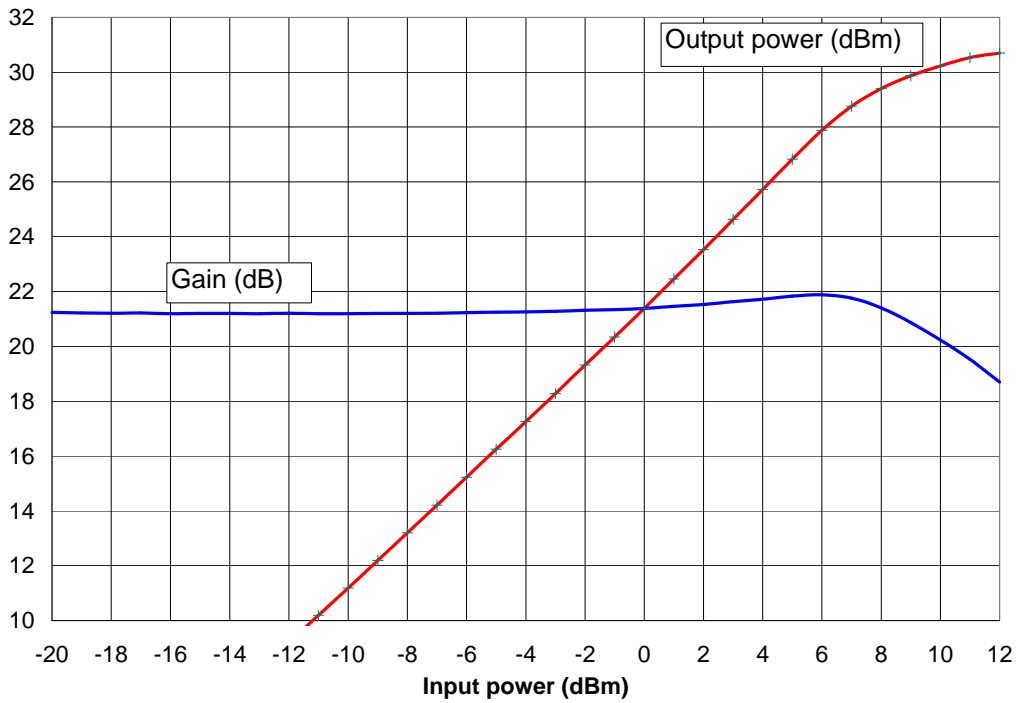


Drain current versus Pin & Temperature @ Rffreq= 14GHz

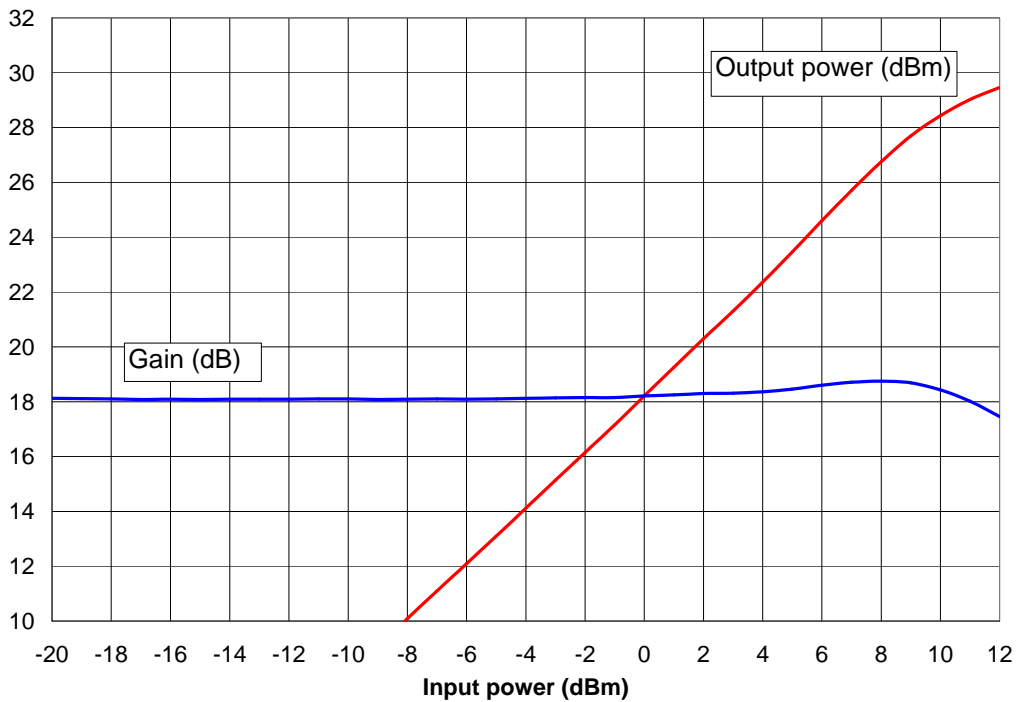


*Preliminary*

Gain & Pout versus Pin @ Rffreq=7GHz, 25°C



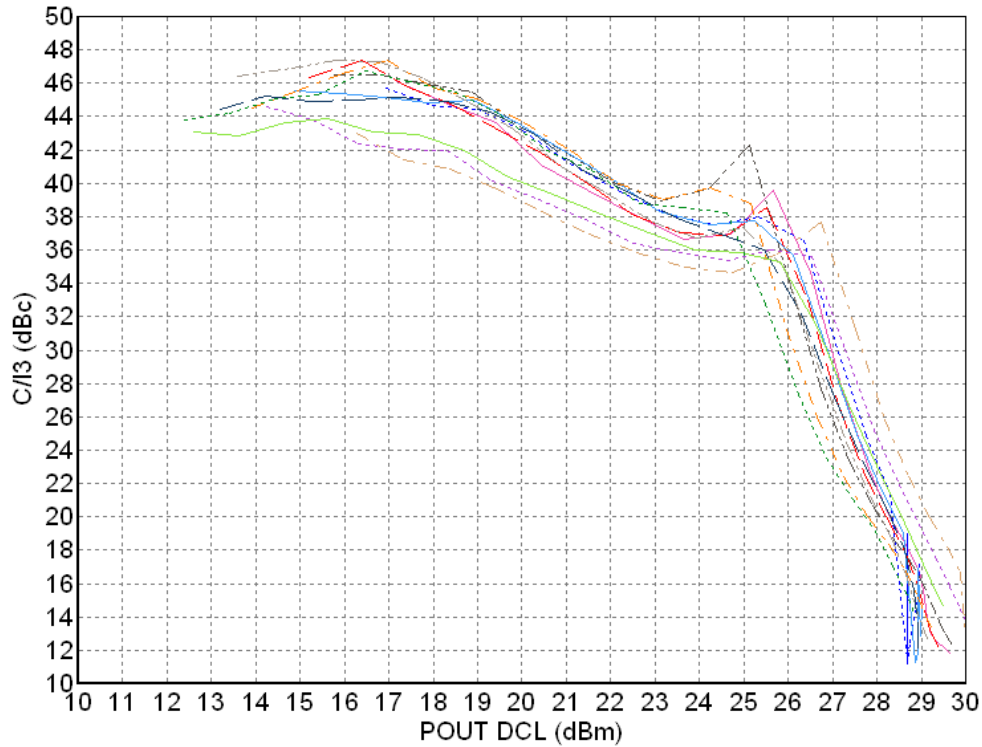
Gain & Pout versus Pin @ Rffreq=15GHz, 25°C



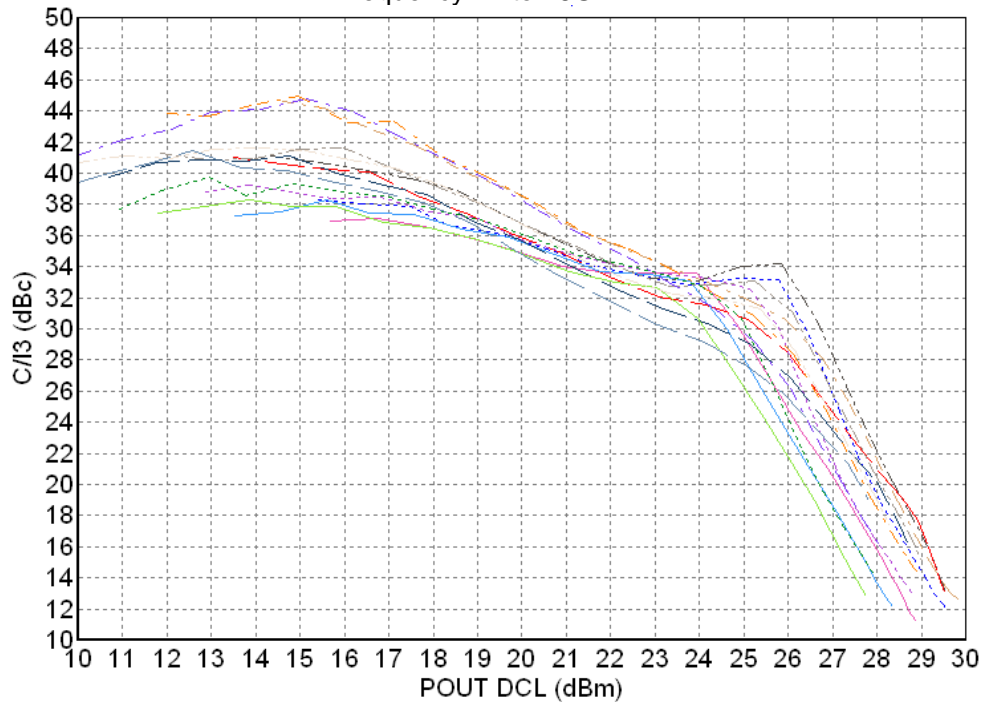
C/I3 versus Pout DCL at Temperature -40, +25, +75°C

*Preliminary*

Frequency 7 to 10GHz



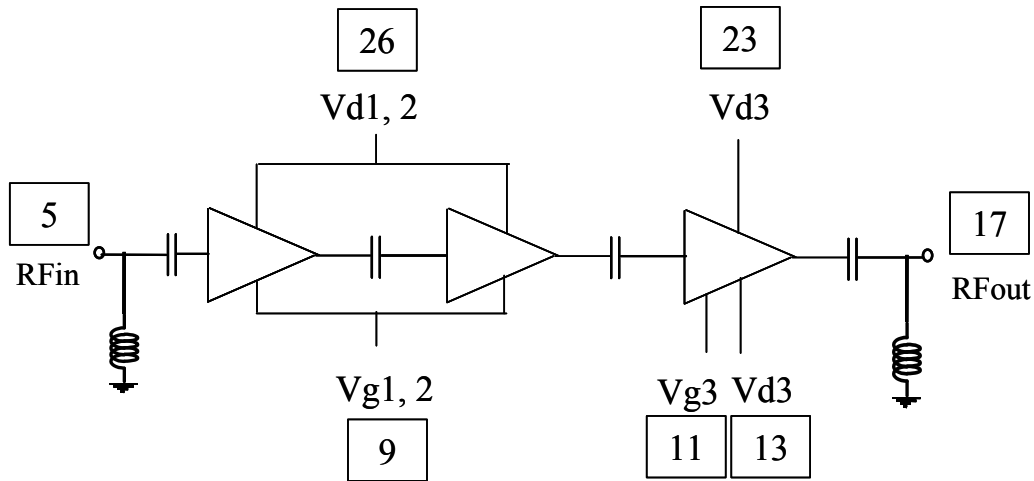
Frequency 12 to 16GHz



*Preliminary*

**Note**

Due to ESD protection, RFin and RFout are DC grounded, an external capacitance might be requested to isolate the product from external voltage that could be present on the RF accesses.



ESD protections are also implemented on gate accesses.

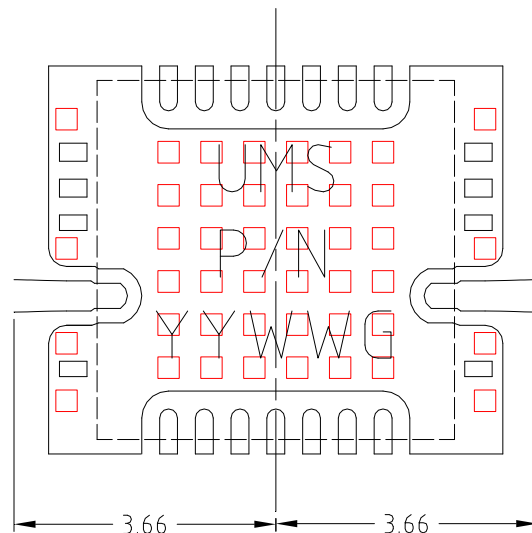
The DC connections do not include any decoupling capacitor in package, therefore it is mandatory to provide a good external DC decoupling on the PC board, as close as possible to the package.

**Definition of the Sij reference planes**

The reference planes are defined from the footprint of the recommended characterization board shown below under the number 96402.

The reference is the symmetrical axis of the package. The input and output reference planes are located at 3.66mm offset (input wise and output wise respec.) from this axis.

Then, the given Sij incorporates this land pattern.



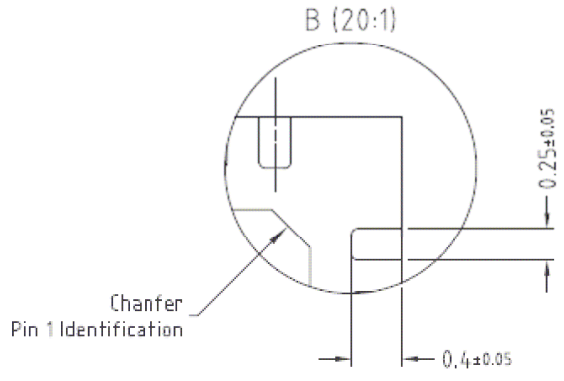
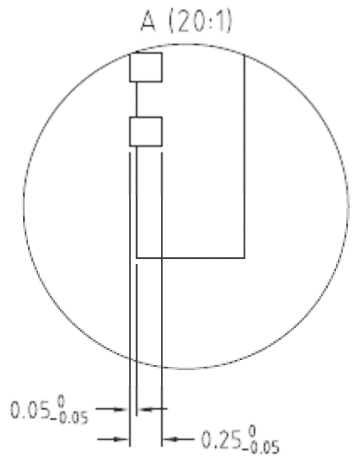
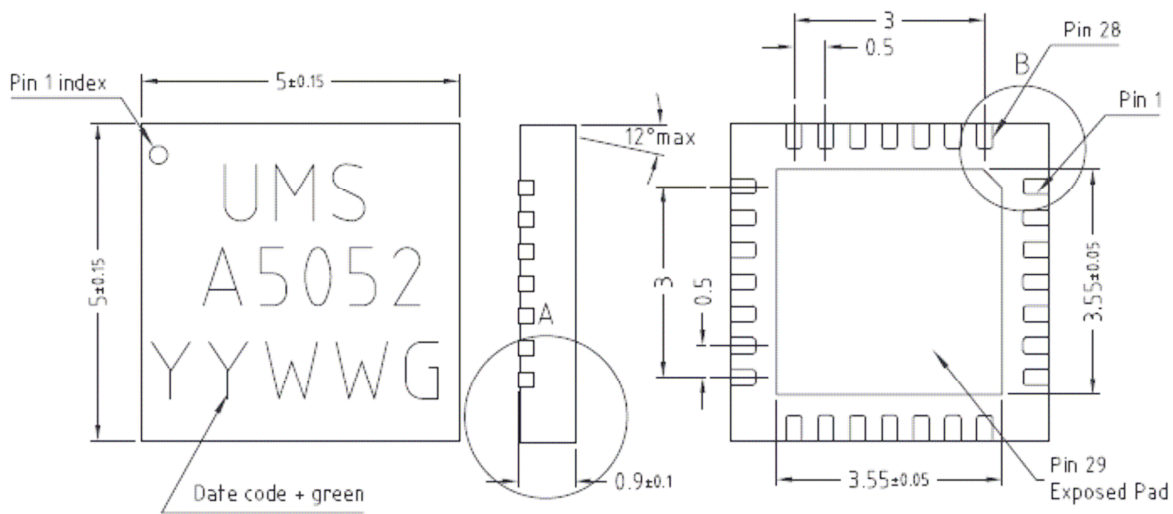


# 7-16GHz High Power Amplifier

CHA5052-QGG

*Preliminary*

## Package outline



Matt tin, Lead free (Green)  
 Units : mm  
 From the standard : JEDEC M0-220 [VEED-6]

|            |            |             |                     |
|------------|------------|-------------|---------------------|
| 1- Gnd     | 10- Nc     | 19- Gnd     | 28- Nc              |
| 2- Nc      | 11- VG3    | 20- Nc      | 29- GND Exposed Pad |
| 3- Gnd     | 12- Nc     | 21- Gnd     |                     |
| 4- Gnd     | 13- VD3    | 22- Nc      |                     |
| 5- RF IN   | 14- Nc     | 23- VD3     |                     |
| 6- Gnd     | 15- Gnd    | 24- Nc      |                     |
| 7- Gnd     | 16- Gnd    | 25- Nc      |                     |
| 8- Nc      | 17- RF OUT | 26- VD1-VD2 |                     |
| 9- VG1-VG2 | 18- Gnd    | 27- Nc      |                     |

## SMD mounting procedure

The SMD leadless package has been designed for high volume surface mount PCB assembly process. The dimensions and footprint required for the PCB (motherboard) are given in the drawings above.

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

Ref: DSCHA5052QGG7033 - 02 Feb 07 9/10 /Specifications subject to change without notice

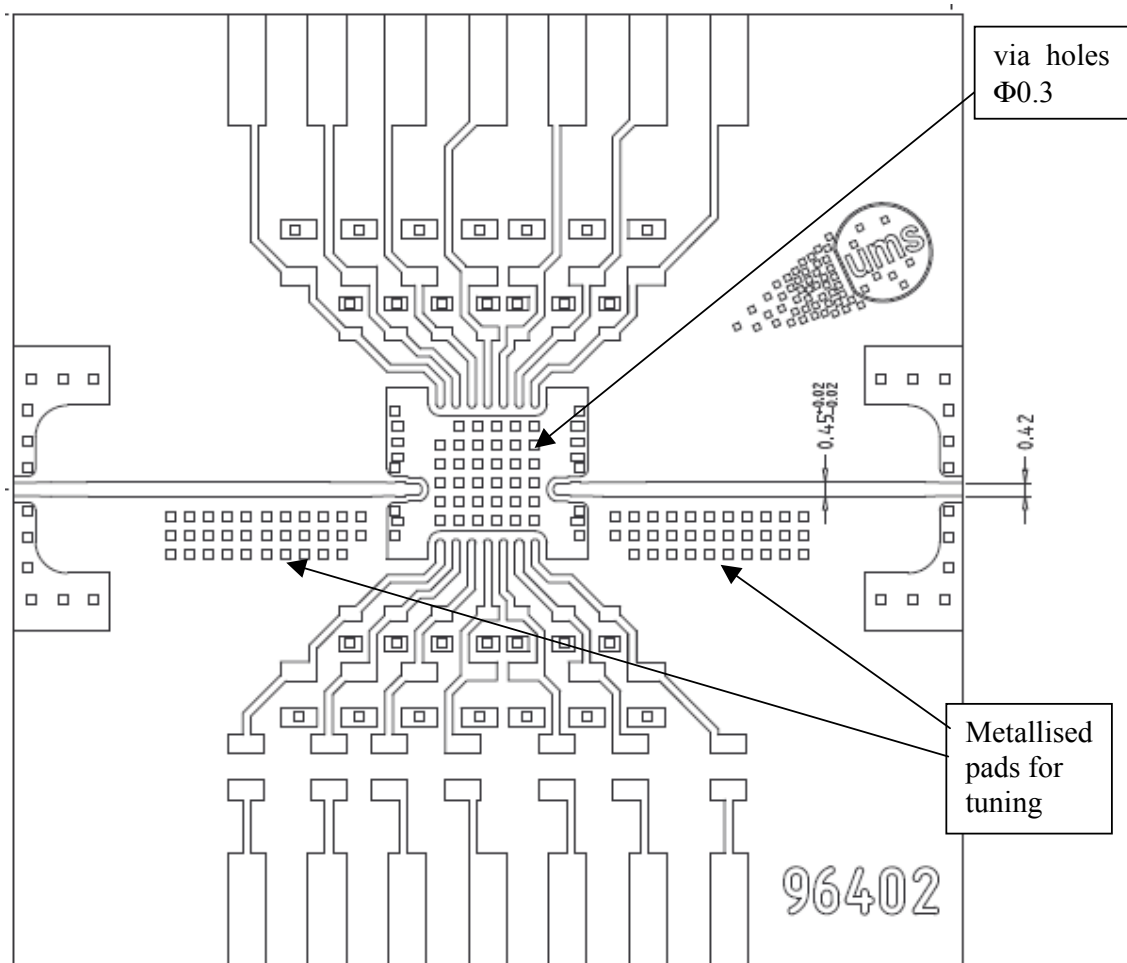
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### Proposed Assembly board "96402" for the 28L-QFN5x5 products characterization.

*Preliminary*

- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Using a microstrip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.



### Ordering Information

QFN 5x5 RoHS compliant package: CHA5052-QGG/XY

Stick: XY = 20      Tape & reel: XY = 21

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