

## 7-13GHz Low Noise Amplifier

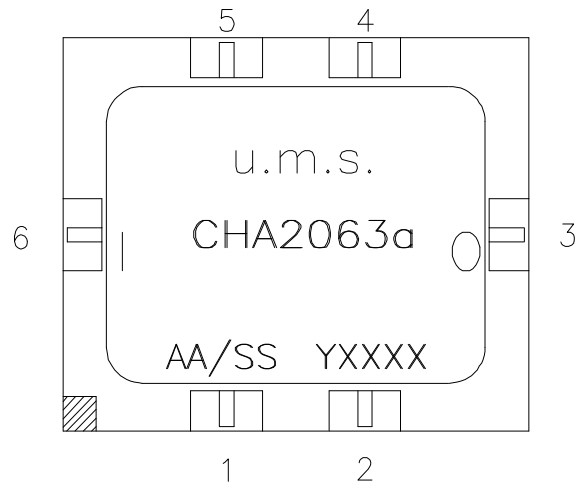
### GaAs Monolithic Microwave IC

#### Description

The CHA2063a is a two-stage wide band monolithic low noise amplifier.

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

It is supplied in chip form or in an hermetic leadless ceramic package.



#### Main Features

- Broad band performance 7-13GHz
- 2.0dB noise figure, 8-13GHz
- 19dB gain
- Low DC power consumption, 40mA
- 18dBm 3rd order intercept point
- Chip size : 1,52 x 1,27 x 0.1mm

#### Pin Out

- 1 - NC
- 2 - NC
- 3 - RF output
- 4 - NC
- 5 - Vdd
- 6 - RF input

#### Main Characteristics

Tamb = +25°C, package form

| Symbol     | Parameter                                     | Min | Typ        | Max        | Unit |
|------------|-----------------------------------------------|-----|------------|------------|------|
| NF         | Noise figure, 7-8GHz<br>Noise figure, 8-13GHz |     | 2.5<br>2.0 | 3.0<br>2.5 | dB   |
| G          | Gain                                          | 16  | 19         |            | dB   |
| $\Delta$ G | Gain flatness                                 |     | $\pm 2.0$  |            | dB   |

ESD Protections : Electrostatic discharge sensitive device observe handling precautions !

## Electrical Characteristics

### Package form

Tamb = +25°C, Vd = +4V

| Symbol     | Parameter                                     | Test Conditions | Min | Typ     | Max   | Unit |
|------------|-----------------------------------------------|-----------------|-----|---------|-------|------|
| Fop        | Operating frequency range                     |                 | 7   |         | 13    | Ghz  |
| G          | Gain                                          |                 | 16  | 19      |       | dB   |
| $\Delta G$ | Gain flatness                                 |                 |     | $\pm 2$ |       | dB   |
| NF         | Noise figure 7-8 Ghz                          |                 |     | 2.5     | 3.0   | dB   |
|            | Noise figure 8-13 GHz                         |                 |     | 2.0     | 2.5   |      |
| VSWRin     | Input VSWR                                    |                 |     | 2.0:1   | 2.5:1 |      |
| VSWRout    | Ouput VSWR                                    |                 |     | 2.0:1   | 2.5:1 |      |
| P1dB       | Output power at 1dB gain compression F=10 GHz |                 |     | 8       |       | dBm  |
| IP3        | 3rd order intercept point                     |                 |     | 18      |       | dBm  |
| Id         | Drain bias current                            |                 |     | 40      | 60    | mA   |

## Absolute Maximum Ratings

Tamb = +25°C

| Symbol | Parameter                              | Values      | Unit |
|--------|----------------------------------------|-------------|------|
| Vd     | Drain bias voltage (3)                 | 5.0         | V    |
| Pin    | Maximum peak input power overdrive (2) | +15         | dBm  |
| Top    | Operating temperature range            | -40 to +85  | °C   |
| Tstg   | Storage temperature range              | -55 to +125 | °C   |

(1) Operation of this device above anyone of these paramaters may cause permanent damage.

(2) Duration < 1s.

(3)See chip biasing option page 9/10

## Electrical Characteristics

### Chip form

Tamb = +25°C, Vd = +4V

| Symbol     | Parameter                                     | Test Conditions | Min | Typ     | Max   | Unit |
|------------|-----------------------------------------------|-----------------|-----|---------|-------|------|
| Fop        | Operating frequency range                     | (1)             | 7   |         | 12    | Ghz  |
| G          | Gain                                          |                 | 17  | 19      |       | dB   |
| $\Delta G$ | Gain flatness                                 |                 |     | $\pm 2$ |       | dB   |
| NF         | Noise figure 7-8 Ghz                          |                 |     | 2.5     | 3.0   | dB   |
|            | Noise figure 8-12 GHz                         |                 |     | 2.0     | 2.5   |      |
| VSWRin     | Input VSWR                                    | (1)             |     | 2.0:1   | 3.0:1 |      |
| VSWRout    | Ouput VSWR                                    | (1)             |     | 2.0:1   | 3.0:1 |      |
| P1dB       | Output power at 1dB gain compression F=10 GHz |                 |     | 8       |       | dBm  |
| IP3        | 3rd order intercept point                     |                 |     | 18      |       | dBm  |
| Id         | Drain bias current                            |                 |     | 40      | 80    | mA   |

(1) These values are representative of on-wafer measurements that are made without bonding wires at the RF ports. When the chip is connected with typical 0.3 nH input and output bonding wires, the indicated parameter values are close to those of the CHA2063a packaged product.

## Typical on Wafer Scattering Parameters

Tamb = +25°C

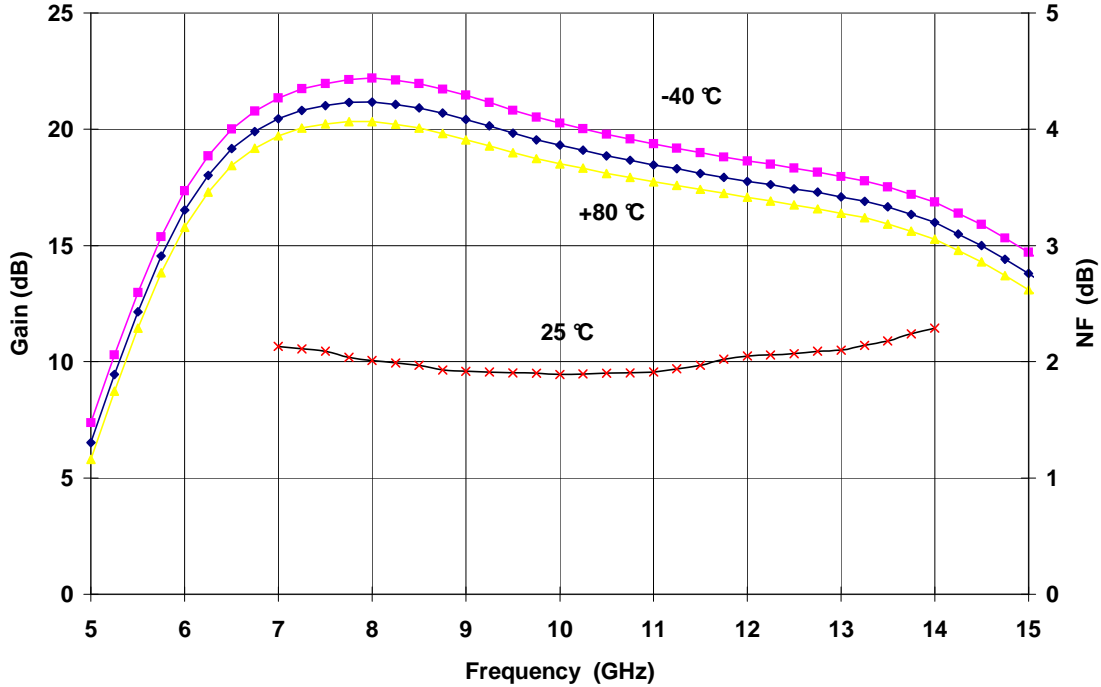
Vd = 4.0V ; Vg1 = Vg2 = +2.5Volt ; Id = 40mA ( A,B,C,D & E not connected )

(see chip biasing option page 9/10)

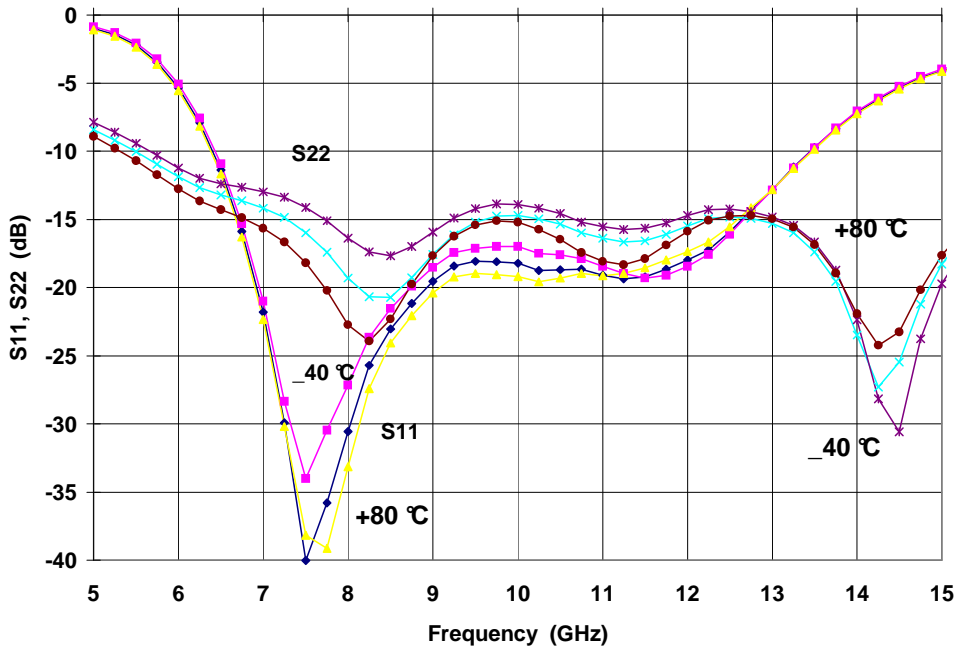
| Freq<br>GHz | S11<br>dB | S11<br>° | S12<br>dB | S12<br>° | S21<br>dB | S21<br>° | S22<br>dB | S22<br>° |
|-------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| 5.00        | -0.86     | -91.7    | --65.97   | -63.6    | 6.08      | -175.1   | -7.99     | -131.3   |
| 5.50        | -1.66     | -109.6   | -57.28    | -77.7    | 11.49     | 152.4    | -9.91     | -139.3   |
| 6.00        | -3.56     | -131.8   | -50.70    | -105.2   | 16.03     | 113.4    | -11.62    | -143.8   |
| 6.50        | -7.75     | -153.2   | -46.25    | -137.6   | 18.99     | 69.3     | -12.74    | -150.7   |
| 7.00        | -14.77    | -159.2   | -43.76    | -167.7   | 20.39     | 27.7     | -14.62    | -164.1   |
| 7.50        | -21.16    | -116.9   | -42.21    | 166.7    | 20.79     | -9.1     | -18.09    | -179.8   |
| 8.00        | -19.40    | -79.1    | -41.19    | 145.2    | 20.89     | -40.9    | -24.49    | 160.0    |
| 8.50        | -16.83    | -61.4    | -40.39    | 127.8    | 20.76     | -69.6    | -34.60    | 38.5     |
| 9.00        | -14.68    | -53.7    | -39.78    | 111.7    | 20.45     | -95.4    | -23.38    | -9.1     |
| 9.50        | -12.52    | -52.6    | -39.31    | 96.9     | 20.16     | -119.5   | -18.53    | -23.3    |
| 10.00       | -10.61    | -57.4    | -38.85    | 83.9     | 19.79     | -141.8   | -15.76    | -31.8    |
| 10.50       | -9.31     | -65.5    | -38.51    | 72.6     | 19.36     | -162.9   | -13.58    | -40.2    |
| 11.00       | -8.38     | -74.2    | -38.14    | 62.0     | 18.85     | 176.6    | -11.92    | -48.5    |
| 11.50       | -7.71     | -83.7    | -37.74    | 52.8     | 18.41     | 157.3    | -10.67    | -57.1    |
| 12.00       | -7.26     | -93.4    | -37.17    | 44.1     | 17.94     | 138.1    | -9.74     | -65.8    |
| 12.50       | -6.86     | -103.8   | -36.62    | 35.4     | 17.40     | 119.5    | -9.01     | -73.5    |
| 13.00       | -6.57     | -114.6   | -35.91    | 27.3     | 16.84     | 101.6    | -8.54     | -81.7    |
| 13.50       | -6.34     | -126.4   | -35.11    | 18.2     | 16.26     | 83.8     | -8.21     | -88.8    |
| 14.00       | -6.18     | -139.4   | -34.27    | 8.5      | 15.65     | 66.5     | -8.05     | -95.7    |
| 14.50       | -6.16     | -153.5   | -33.41    | -1.9     | 15.01     | 49.1     | -8.03     | -101.7   |
| 15.00       | -6.25     | -169.0   | -32.67    | -13.3    | 14.35     | 31.7     | -8.02     | -106.9   |

**Typical Results in package**  
**Typical Response (In package Sij) :**

Tamb = +25°C      Vd = 4.0V ; ; Id = 40mA  
 Gain slope : -0.015dB/°C    Id slope : -0.025mA/°C



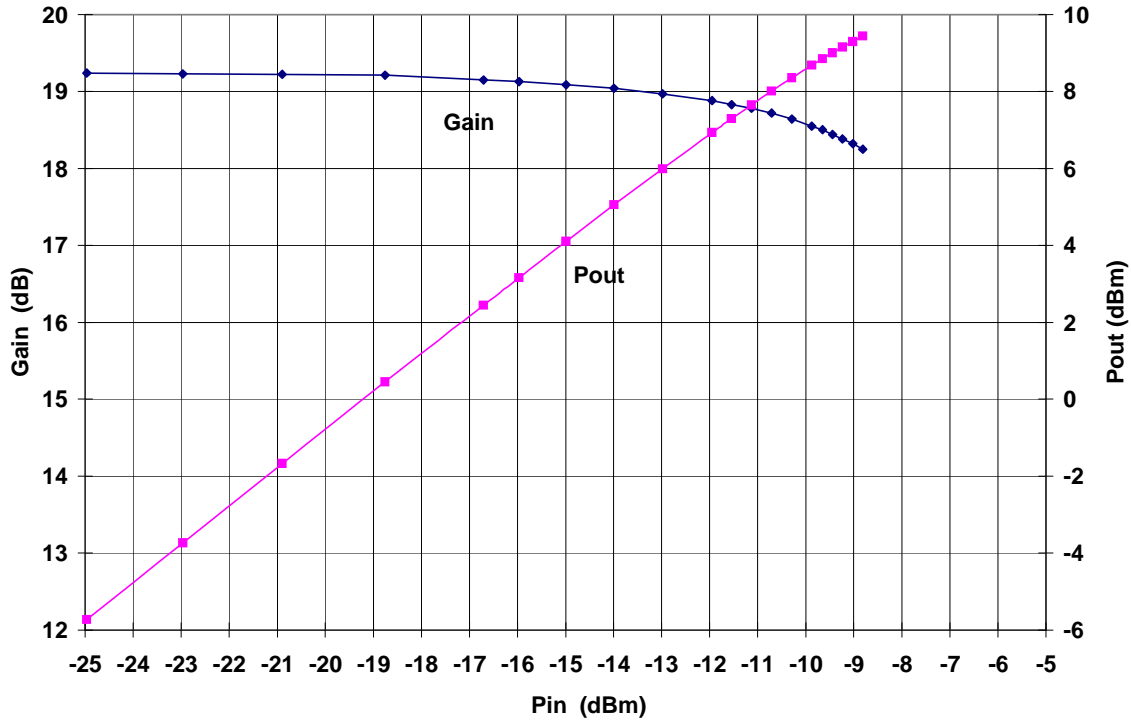
**Typical Gain and Noise Figure measurements in package**



**Typical Matching measurements in package.**

## Typical Output Power measurements in package

Tamb = +25°C      Vd = 4.0V ; Id = 40mA F=10 GHz



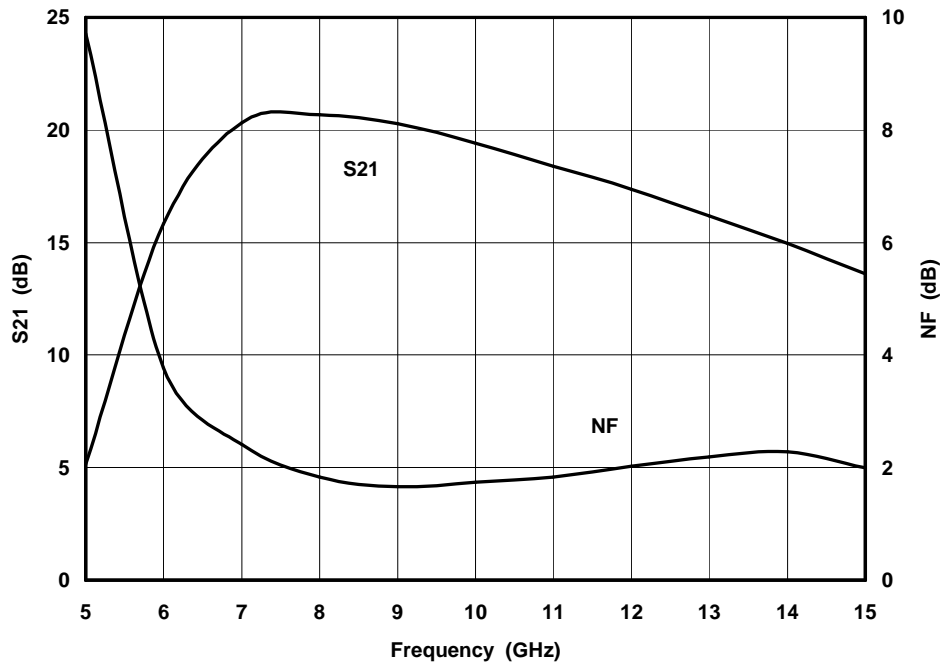
**Typical Results in chip**

**Chip Typical Response ( On wafer Sij ) :**

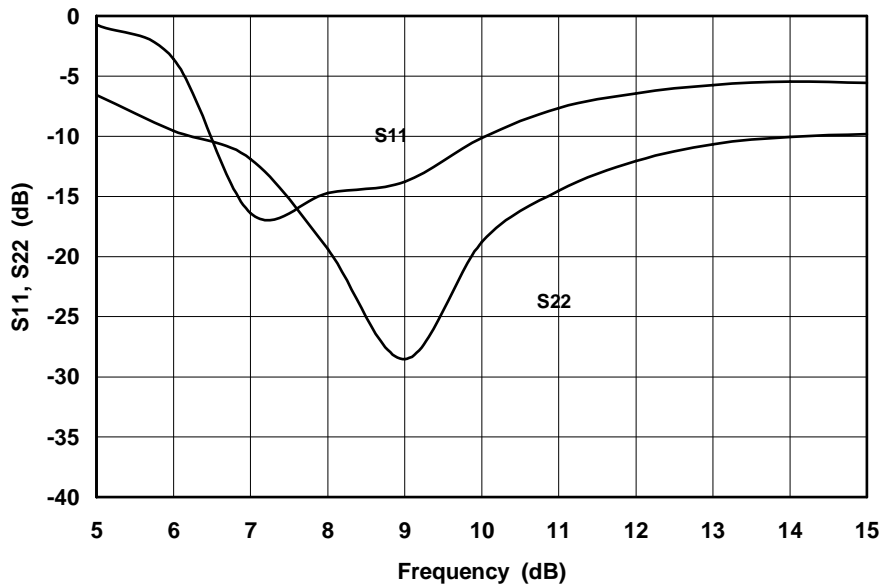
Tamb = +25°C

Vd = 4.0V ; Vg1 = Vg2 = +2.5Volt ; Id = 40mA ( A,B,C,D & E not connected )

(see chip biasing option page 9/10)

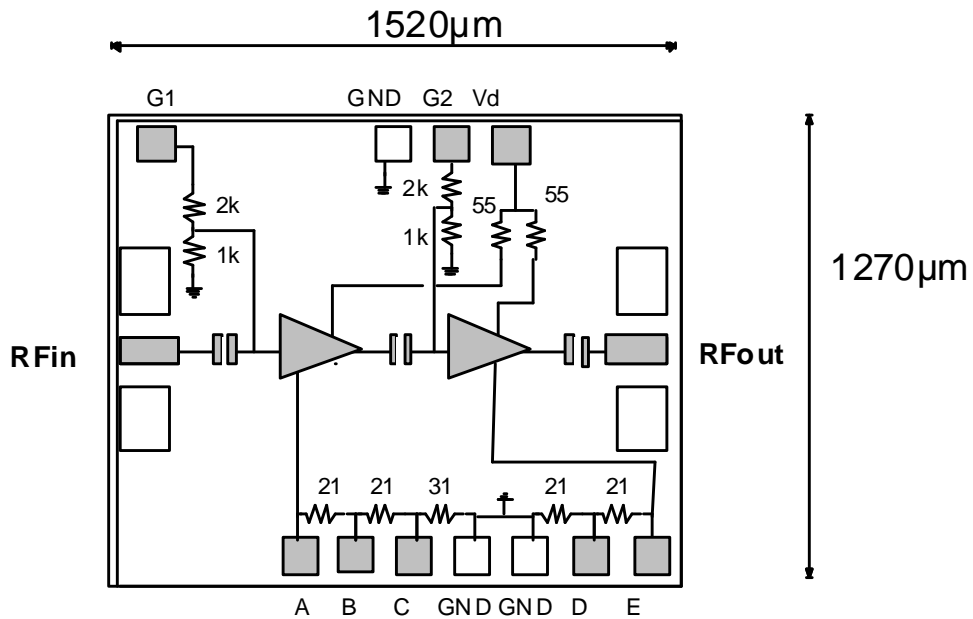


**Typical Gain and Noise Figure measurements on wafer.**



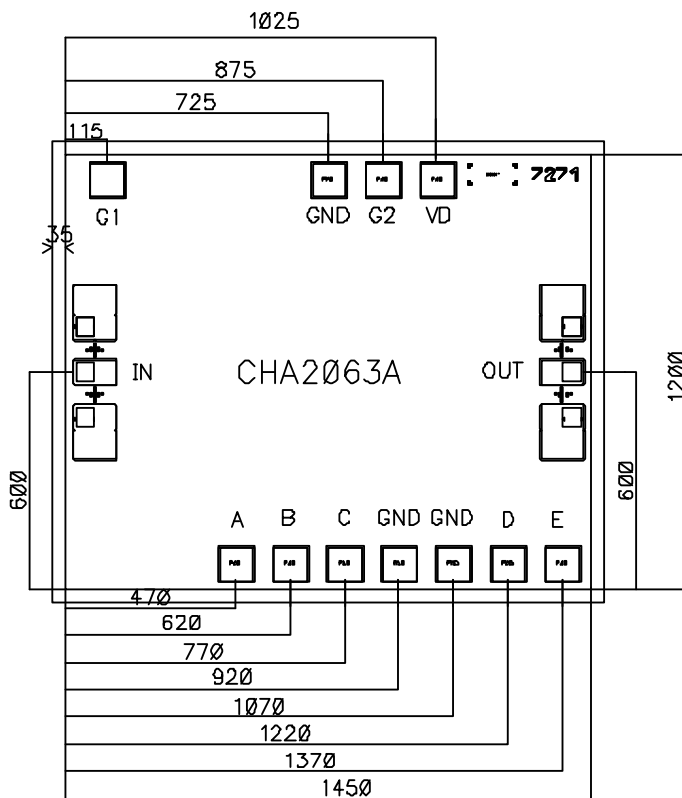
**Typical Matching measurements on wafer.**

## Chip schematic and Pad Identification



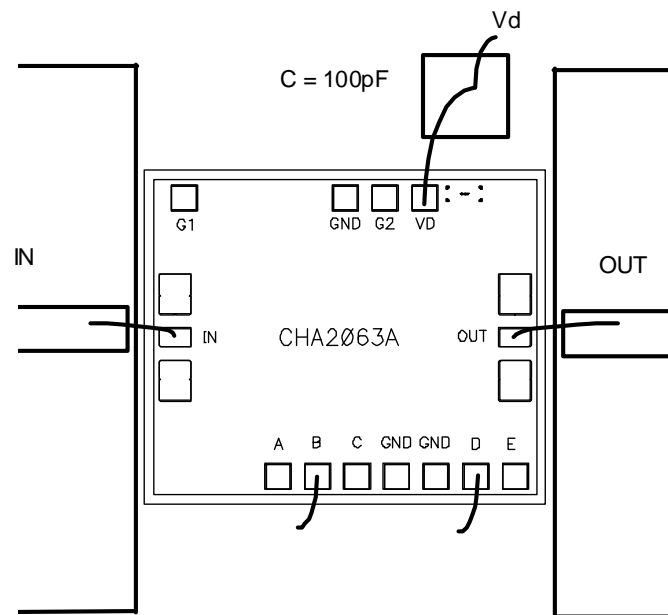
Pad size 100x100µm, chip thickness 100µm

Dimensions : 1520 x 1270µm ± 35µm



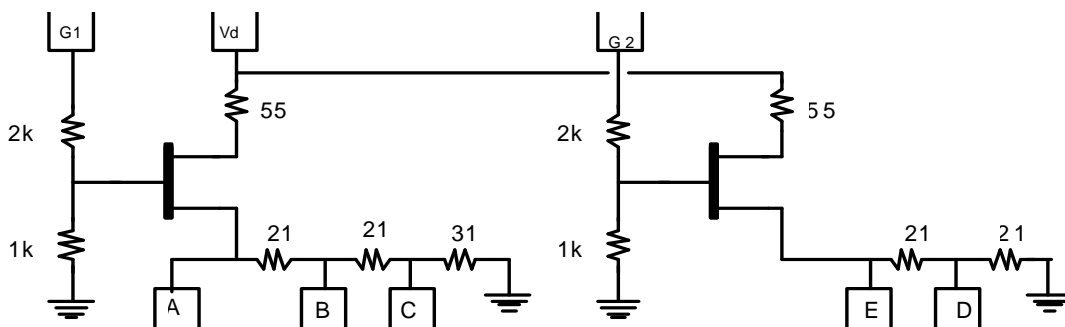


## Typical Chip Assembly



## Chip Biasing options

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



The two requirements are :

N°1 : Not exceed  $V_{ds} = 3.5V$  (internal Drain to Source voltage).

N°2 : Biased in such a way to limit  $V_{gs}$  positive value (internal Gate to Source voltage).

We propose two standard biasing :

Low Noise and low consumption :

$V_d = 4V$  and B & D grounded.

All the other pads non connected ( NC ).

$I_{dd} = 40mA$  &  $P_{out-1dB} = +8dBm$  Typical.

( Equivalent to A,B,C,D,E : NC and  $V_d=4V$  ;  $G1=+2.5V$  ;  $G2=+2.5V$  ).

Low Noise and high output power :

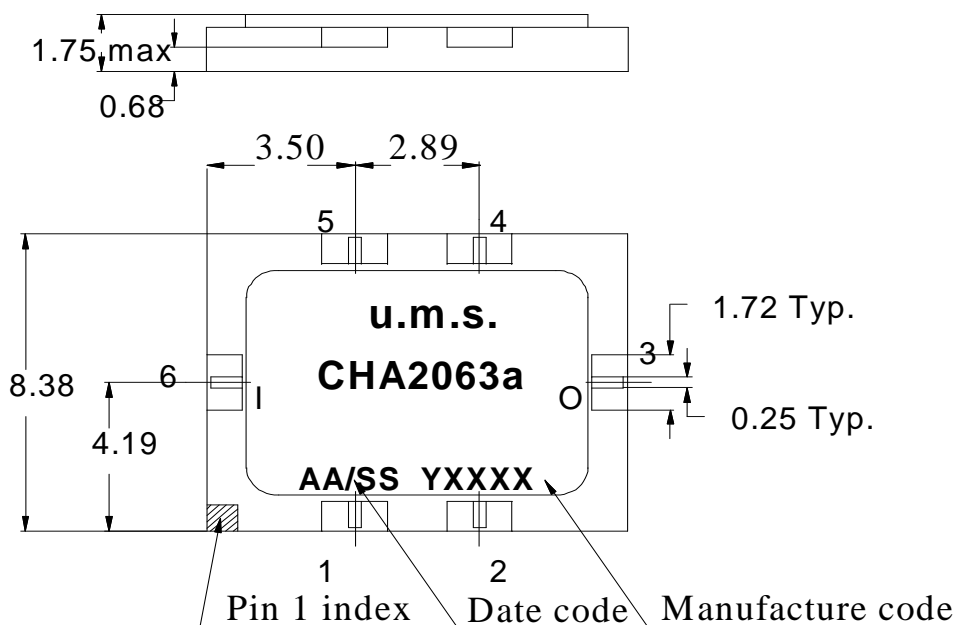
$V_d = 5V$  and B & E grounded.

All the other pads non connected ( NC ).

$I_{dd} = 75mA$  &  $P_{out-1dB} = +13dBm$  Typical.

( Equivalent to A,B,C,D,E : NC and  $V_d=5V$  ;  $G1=+2.5V$  ;  $G2=+1.0V$  ).

## Package Outline



Unit : mm

General tolerance :  $\pm 0.13$

## Ordering Information

Chip form : CHA2063a99F/00  
 Package form : CHA2063aMAF/23

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