

2-18GHz Low Noise Amplifier

GaAs Monolithic Microwave IC

Description

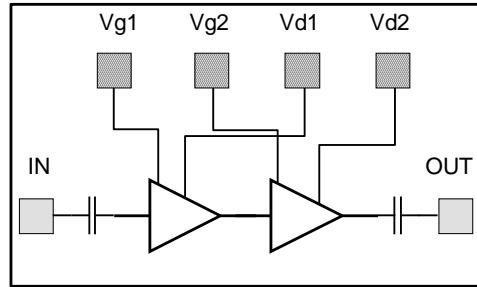
The CHA3218-99F is a two stage very wide band Low Noise Amplifier.

The wide frequency band associated to a 2dB low noise figure makes this circuit very versatile for very high performance systems.

It is designed for a wide range of applications, from military to commercial communication systems.

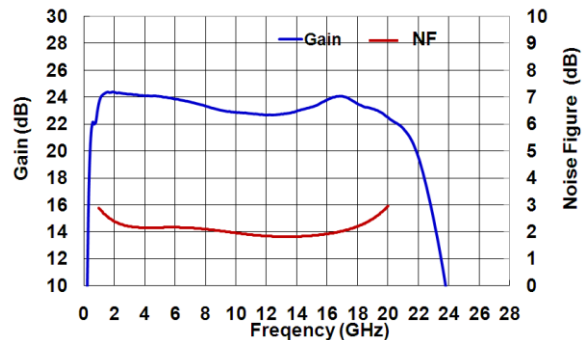
The circuit is manufactured with a pHEMT process, 0.15µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

- Broadband performances: 2-18GHz
- Noise figure : 2dB
- Output power: 15dBm @ 1dBcomp
- Linear gain: 24dB
- High linearity: 25dBm
- Quiescent bias point: Vd=4V, Id=120mA
- Chip size 3.07x1.57x0.1mm



Main Electrical Characteristics

Tamb.= +25°C

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|-------------------------|-----|-----|-----|------|
| Freq | Frequency range | 2 | | 18 | GHz |
| Gain | Linear Gain | | 24 | | dB |
| NF | Noise Figure | | 2 | | dB |
| Pout | Output Power @1dB comp. | | 15 | | dBm |

Electrical Characteristics

Tamb.= +25°C, Vd = +4V

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|---------------------------------------|-----|--------|-----|------|
| Freq | Operating frequency | 2 | | 18 | GHz |
| G | Small Signal Gain | | 24 | | dB |
| S11 | Input Return Loss from 2GHz to 16GHz | | 8 | | dB |
| | Input Return Loss from 16GHz to 18GHz | | 4 | | dB |
| S22 | Output Return Loss | | 12 | | dB |
| NF | Noise Figure | | 2 | | dB |
| P1dB | Output power at 1dB gain compression | | 15 | | dBm |
| OIP3 | Output 3rd order intercept point | | 25 | | dBm |
| Vd | Positive supply voltage | | 4 | | V |
| Vg | Negative supply voltage | | -0.45V | | V |
| Id | Positive supply DC current | | 120 | | mA |

These values are representative of measurements made in test fixture that are made with bonding wires at the RF ports.

Absolute Maximum Ratings ⁽¹⁾

Tamb.= +25°C

| Symbol | Parameter | Values | Unit |
|--------|-------------------------------------|-------------|------|
| Vd | Drain bias voltage | 6V | V |
| Id | Drain bias current | 200 | mA |
| Vg | Gate bias voltage | -2 to -0.3 | V |
| Tj | Junction temperature ⁽²⁾ | 175 | °C |
| Ta | Operating temperature range | -40 to +85 | °C |
| Tstg | Storage temperature range | -55 to +150 | °C |

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

Typical Bias Conditions

Tamb.= +25°C

| Symbol | Pad N° | Parameter | Values | Unit |
|--------|----------|----------------------|--------|------|
| Vd | VD1, VD2 | Drain supply voltage | 4 | V |
| Vg | VG1, VG2 | Gate supply voltage | -0.45 | V |

Typical on-wafer Sij parameters

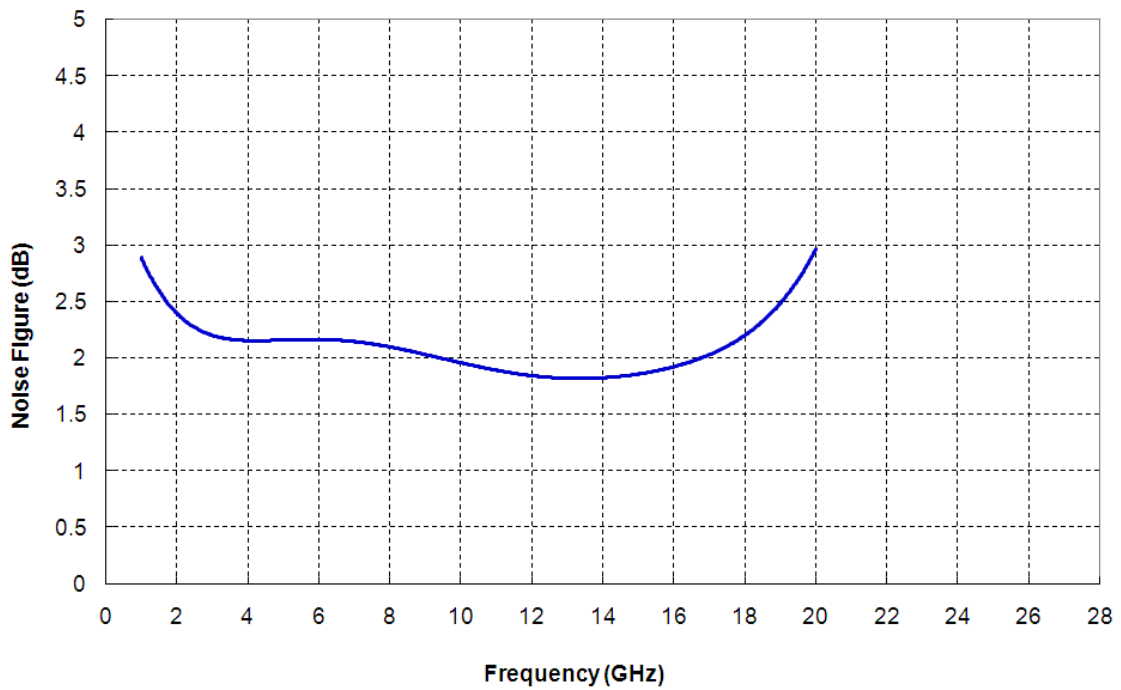
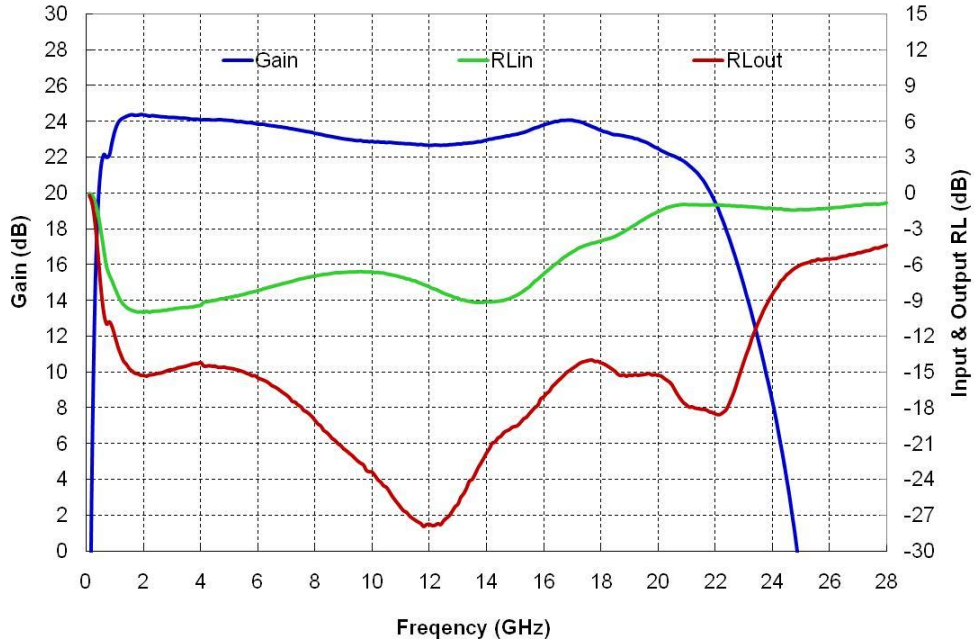
Tamb.= +25°C, Vd = +4.0V, Id = 120mA

| Freq (GHz) | S11 (dB) | PhS11 (°) | S12 (dB) | PhS12 (°) | S21 (dB) | PhS21 (°) | S22 (dB) | PhS22 (°) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 1.0 | -6.54 | -68.84 | -66.51 | 120.80 | 20.22 | 9.61 | -10.57 | -165.20 |
| 1.5 | -8.65 | -90.41 | -69.52 | 59.25 | 23.39 | -18.22 | -12.10 | 150.90 |
| 2.0 | -8.98 | -101.30 | -66.71 | -70.17 | 24.52 | -44.21 | -13.55 | 114.90 |
| 2.5 | -8.81 | -111.50 | -66.45 | -6.78 | 24.62 | -67.98 | -14.29 | 98.03 |
| 3.0 | -8.84 | -121.30 | -63.63 | 31.22 | 24.81 | -90.89 | -15.82 | 82.15 |
| 3.5 | -8.62 | -130.40 | -76.10 | 35.29 | 24.79 | -110.50 | -15.54 | 69.41 |
| 4.0 | -8.41 | -138.90 | -82.38 | 120.20 | 24.83 | -129.90 | -15.35 | 54.40 |
| 4.5 | -8.34 | -146.60 | -69.61 | 170.60 | 24.85 | -149.10 | -15.29 | 43.06 |
| 5.0 | -8.15 | -152.90 | -80.83 | -158.00 | 24.88 | -167.80 | -15.14 | 31.56 |
| 5.5 | -8.01 | -160.10 | -70.41 | -142.20 | 24.93 | 173.20 | -15.48 | 17.93 |
| 6.0 | -7.93 | -166.70 | -76.72 | -100.20 | 24.90 | 154.10 | -15.44 | 9.39 |
| 6.5 | -7.88 | -173.60 | -66.20 | -167.50 | 24.90 | 135.30 | -15.84 | 1.16 |
| 7.0 | -7.83 | 179.50 | -74.37 | 141.10 | 24.86 | 116.40 | -16.10 | -8.84 |
| 7.5 | -7.77 | 172.40 | -68.59 | 83.30 | 24.80 | 97.70 | -16.15 | -13.36 |
| 8.0 | -7.81 | 164.70 | -61.56 | 22.11 | 24.76 | 78.88 | -16.93 | -19.65 |
| 8.5 | -7.93 | 156.50 | -74.50 | -79.14 | 24.68 | 59.95 | -17.15 | -26.74 |
| 9.0 | -8.14 | 148.10 | -60.72 | 13.83 | 24.58 | 41.21 | -17.41 | -28.81 |
| 9.5 | -8.45 | 138.90 | -61.33 | -160.50 | 24.50 | 22.53 | -17.58 | -28.73 |
| 10.0 | -8.78 | 129.40 | -57.71 | 61.63 | 24.40 | 3.86 | -17.91 | -30.03 |
| 10.5 | -9.20 | 119.60 | -66.95 | 135.60 | 24.32 | -14.76 | -17.34 | -30.37 |
| 11.0 | -9.69 | 109.00 | -67.69 | -46.82 | 24.24 | -33.33 | -17.57 | -24.55 |
| 11.5 | -10.20 | 98.09 | -56.04 | 116.50 | 24.17 | -51.94 | -17.25 | -32.41 |
| 12.0 | -10.67 | 86.43 | -63.65 | 139.60 | 24.14 | -70.65 | -16.07 | -28.71 |
| 12.5 | -10.97 | 73.94 | -63.23 | 87.11 | 24.16 | -89.46 | -16.07 | -26.83 |
| 13.0 | -10.98 | 61.87 | -69.79 | -23.20 | 24.17 | -108.70 | -15.26 | -31.21 |
| 13.5 | -10.85 | 49.90 | -58.09 | 26.48 | 24.25 | -128.30 | -14.55 | -31.53 |
| 14.0 | -10.26 | 36.84 | -60.33 | -45.50 | 24.32 | -148.50 | -13.76 | -35.57 |
| 14.5 | -9.52 | 25.18 | -56.67 | 87.72 | 24.39 | -169.30 | -12.82 | -38.97 |
| 15.0 | -8.66 | 13.53 | -56.17 | 82.83 | 24.40 | 169.50 | -12.14 | -43.52 |
| 15.5 | -7.37 | 1.83 | -55.80 | 131.80 | 24.40 | 147.50 | -11.62 | -47.52 |
| 16.0 | -6.31 | -9.73 | -68.50 | -19.80 | 24.29 | 125.20 | -10.99 | -50.85 |
| 16.5 | -5.12 | -19.29 | -54.25 | 141.00 | 24.17 | 102.50 | -10.17 | -56.71 |
| 17.0 | -4.21 | -30.54 | -52.76 | -4.26 | 23.98 | 79.88 | -9.57 | -59.52 |
| 17.5 | -3.42 | -40.79 | -49.86 | -28.50 | 23.81 | 56.73 | -9.61 | -67.15 |
| 18.0 | -2.70 | -50.34 | -55.04 | 163.50 | 23.55 | 33.18 | -9.34 | -75.01 |
| 18.5 | -2.01 | -59.27 | -57.27 | -112.00 | 23.28 | 8.48 | -9.76 | -77.78 |
| 19.0 | -1.40 | -67.90 | -55.13 | -111.50 | 22.96 | -17.05 | -10.46 | -80.96 |
| 19.5 | -0.89 | -76.81 | -59.46 | 52.25 | 22.21 | -40.98 | -9.23 | -78.01 |
| 20.0 | -0.44 | -84.70 | -47.07 | -60.90 | 21.91 | -60.36 | -8.24 | -93.21 |

Typical Board Measurements

Tamb.= +25°C, Vd = +4V, Id = 120mA

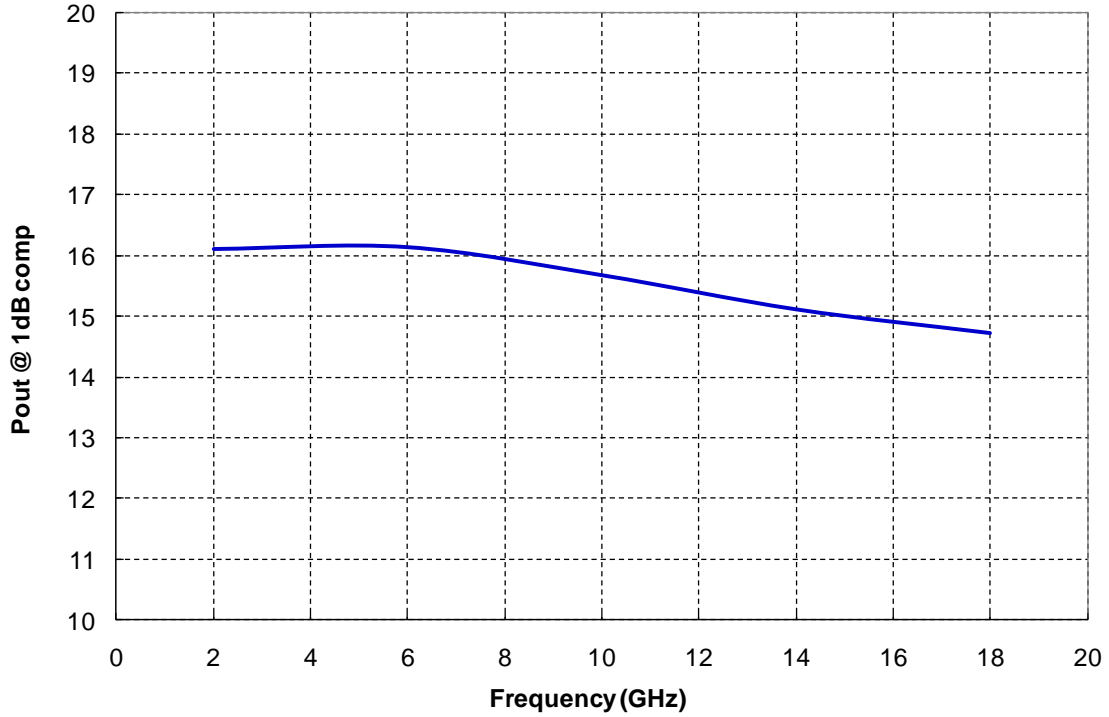
[S] parameters & Noise Figure



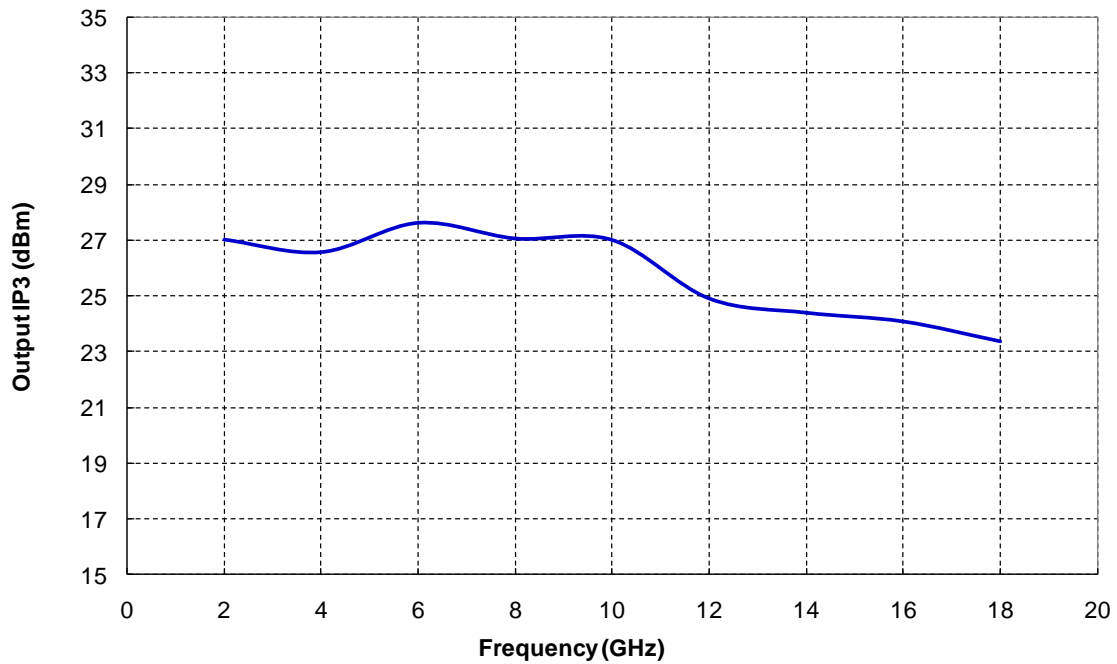
Typical Board Measurements

Tamb.= +25°C, Vd = +4V, Id = 120mA

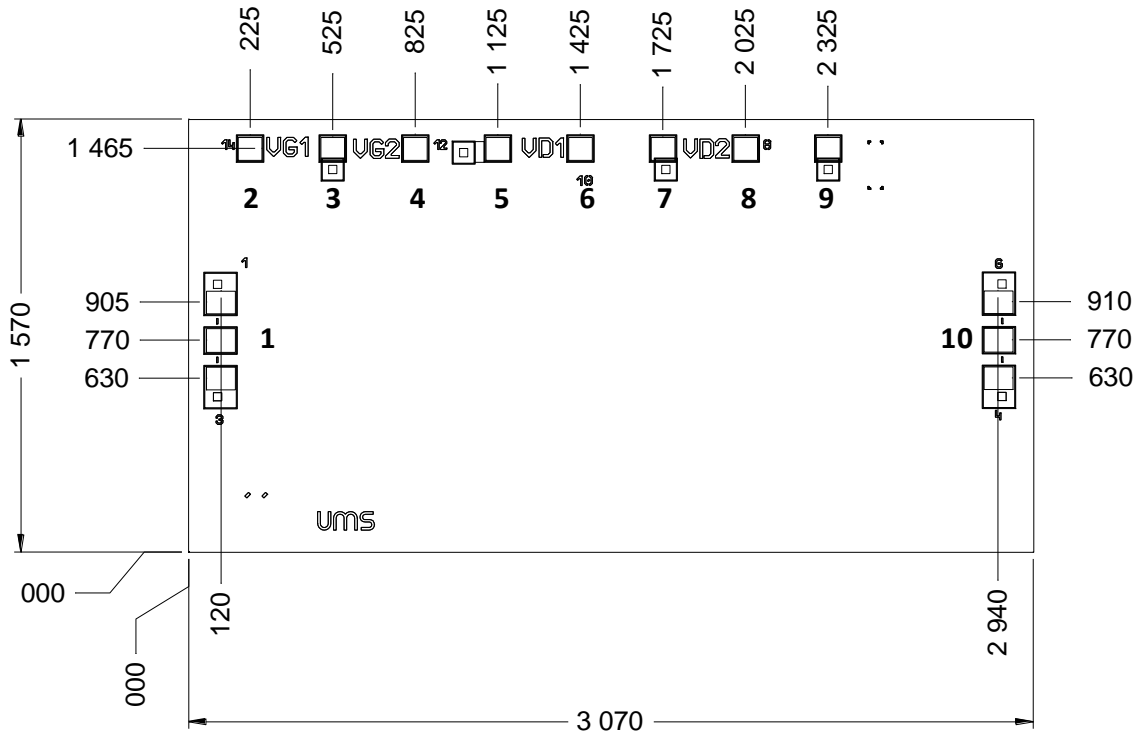
Output Power @ 1dBcomp versus Frequency



Output Power IP3 versus Frequency



Mechanical data

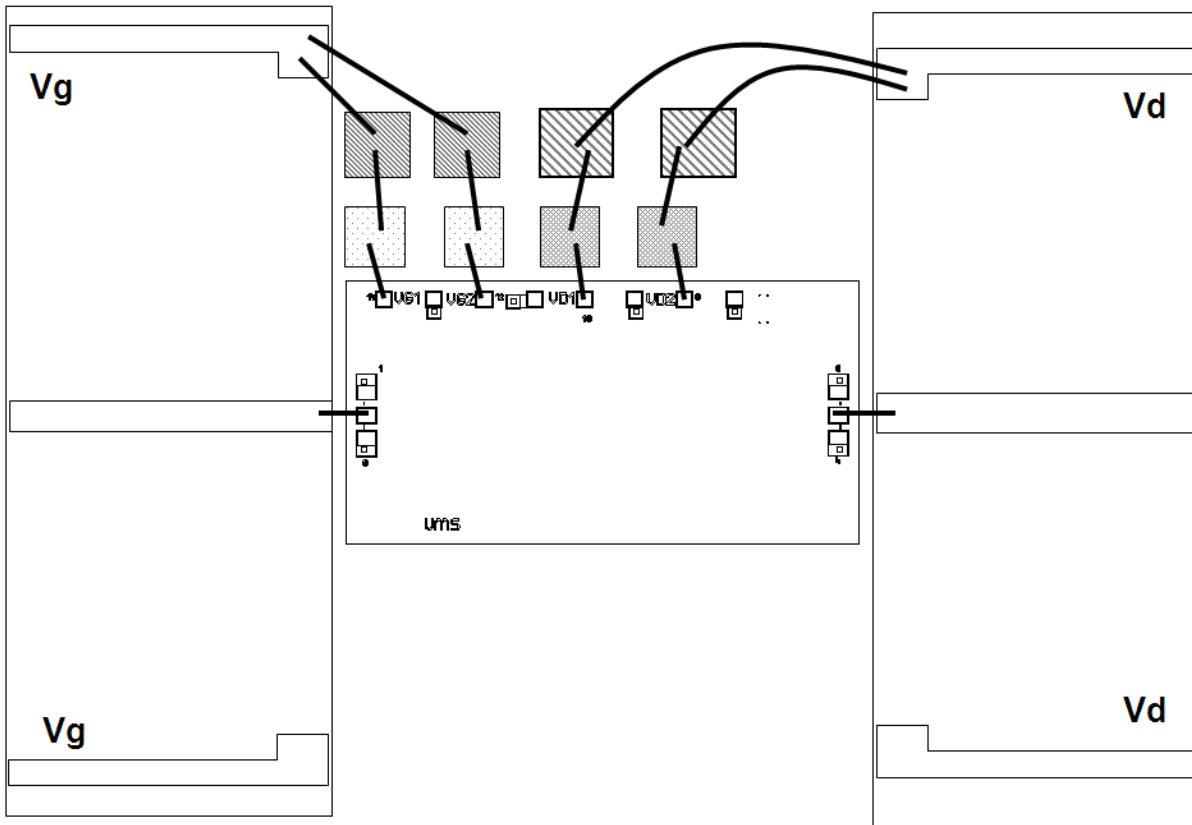


Chip thickness: 100µm.
 Chip size: 3070x1570 ±35µm
 All dimensions are in micrometers

RF pads (1, 10) = 100 x 122µm²
 DC pads (2, 4, 6, 8) = 100 x 100µm²

| Pin number | Pin name | Description |
|------------|----------|------------------------------|
| 1 | IN | Input RF |
| 2, 4, | VG1, VG2 | Gate supply voltage |
| 6, 8 | VD1, VD2 | Drain supply voltage |
| 3, 5, 7, 9 | GND | Ground (no bonding required) |
| 10 | OUT | Output RF |

Recommended assembly plan



25µm wedge bonding is preferred

Recommended circuit bonding table

| Label | Type | Decoupling | Comment |
|----------|------|---------------|----------------------|
| VD1, VD2 | Vd | 470pF & 220nF | Drain supply voltage |
| VG1, VG2 | Vg | 100pF & 10nF | Gate supply voltage |

Notes

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 products.

Ordering Information

Chip form:

CHA3218-99F/00

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