

80-105GHz Balanced Low Noise Amplifier

GaAs Monolithic Microwave IC

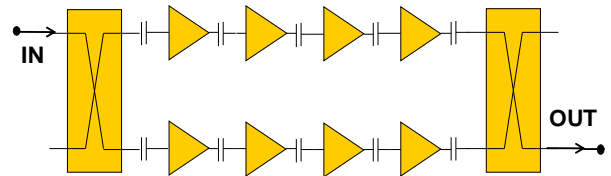
Description

The CHA1008-99F is a broadband, balanced, four-stage monolithic low noise amplifier.

It is designed for Millimeter-Wave Imaging applications and can be used in commercial digital radios and wireless LANs.

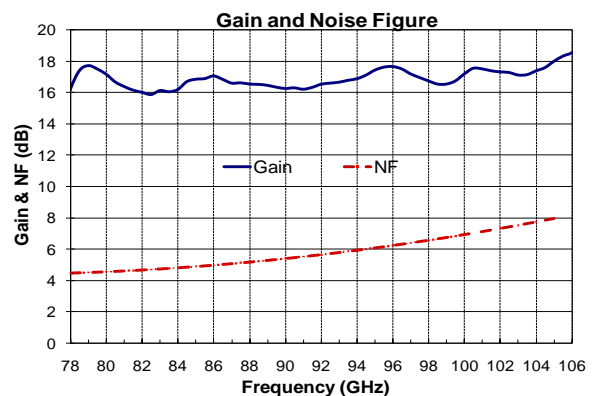
The circuit is manufactured on a pHEMT process, 0.10µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

- Broadband performances: 80-105GHz
- Balanced configuration
- 16dB linear gain from 80 to 90GHz
- 5dB noise figure from 80 to 90GHz
- DC bias: VD=2.5V @ ID=115mA
- Chip size 3.40x1.60x0.07mm



Main Electrical Characteristics

Tamb.= +25°C

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|---------------------------------|-----|-----|-----|------|
| Freq | Frequency range | 80 | | 105 | GHz |
| Gain | Linear Gain (from 80 to 90GHz) | | 16 | | dB |
| NF | Noise Figure (from 80 to 90GHz) | | 5 | | dB |
| Pout | Output Power @1dB comp. | | 5 | | dBm |

CHA1008-99F 80-105GHz Balanced Low Noise Amplifier

Electrical Characteristics

Tamb.= +25°C, VD = 2.5V

| Symbol | Parameter | Min | Typ | Max | Unit |
|------------------|---|-----|---|-------------------|------|
| Freq | Frequency range | 80 | | 105 | GHz |
| Gain | Linear Gain | | 17 | | dB |
| NF | Noise Figure | | [80-90]GHz [90-100]GHz [100-105]GHz | 5.0 6.5 7.5 | dB |
| RLin | Input Return Loss | | -14 | | dB |
| RLout | Output Return Loss | | -12 | | dB |
| IN/OUT impedance | Input & Output impedance in the chip plan | | 50 | | Ohms |
| OP1dB | Output Power @1dB compression | | 5 | | dBm |
| VG1, VG2 | Gate voltages (either on VG1 or VG2 or both on VG1 & VG2) | | +0.15 | | V |
| VD | Drain voltage | | 2.5 | | V |
| ID | Drain current | | 115 | | mA |

These values are representative of on-wafer measurements that are made without bonding wires at the RF ports.

Absolute Maximum Ratings ⁽¹⁾

Tamb.= +25°C

| Symbol | Parameter | Values | Unit |
|----------|---|-------------|------|
| VD | Drain bias voltage | 3 | V |
| ID | Drain bias current | 150 | mA |
| VG1, VG2 | Gate bias voltage | -2 to +0.8 | V |
| Pin | Maximum peak input power overdrive ⁽²⁾ | 0 | dBm |
| Tj | Junction temperature | 175 | °C |
| Ta | Operating temperature range | -40 to +85 | °C |
| Tstg | Storage temperature range | -55 to +150 | °C |

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

⁽²⁾ Duration < 1s.

Typical Bias Conditions

Tamb.= +25°C

| Symbol | Parameter | Values | Unit |
|----------|--|--------|------|
| VD | DC drain voltage | 2.5 | V |
| ID | Drain current controlled with VG1 or VG2 | 115 | mA |
| VG1, VG2 | DC gate voltages linked together into the circuit (only one can be used) | +0.15 | V |

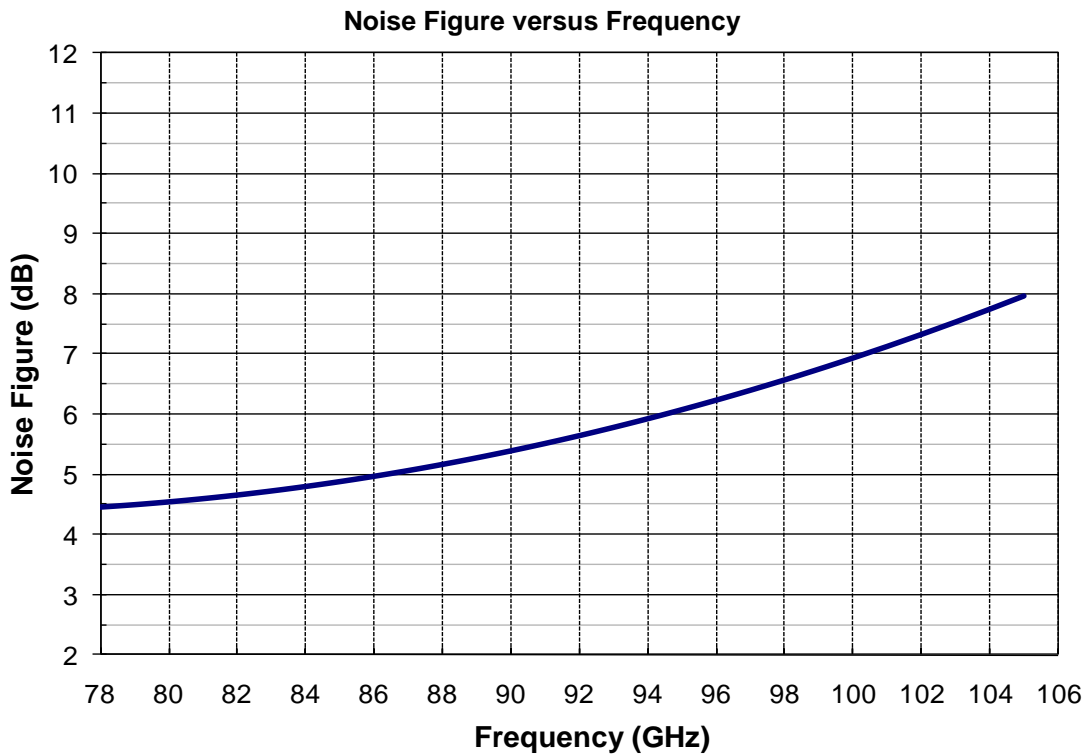
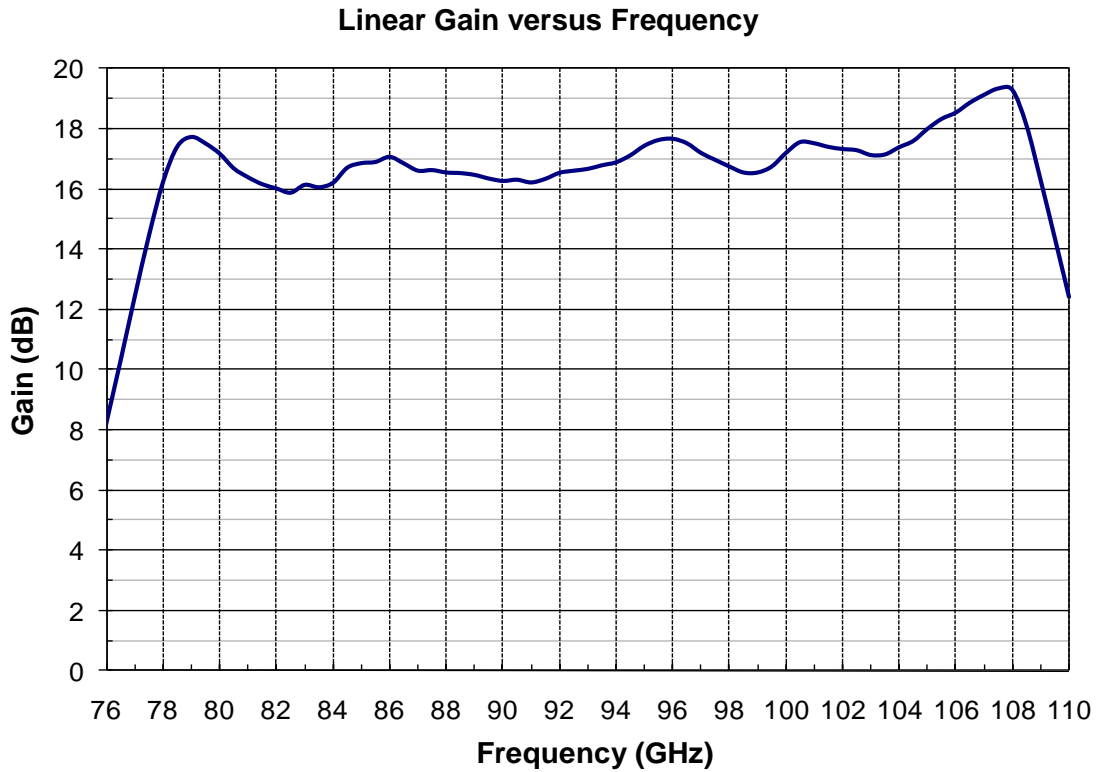
Typical on-wafer Sij parameters

Tamb.= +25°C, VD = 2.5V, ID = 115mA

| Freq (GHz) | S11 (dB) | PhS11 (°) | S12 (dB) | PhS12 (°) | S21 (dB) | PhS21 (°) | S22 (dB) | PhS22 (°) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 70 | -9.62 | -27.4 | -46.61 | -1.7 | -14.84 | -77.4 | -19.06 | -147.5 |
| 71 | -7.90 | -59.9 | -45.20 | -29.0 | -12.29 | -97.7 | -23.78 | -147.3 |
| 72 | -6.07 | -92.8 | -40.60 | -79.9 | -9.91 | -112.3 | -15.39 | -132.2 |
| 73 | -4.55 | -129.0 | -39.39 | -141.1 | -6.20 | -126.5 | -15.31 | -151.5 |
| 74 | -2.99 | -177.8 | -38.67 | -178.6 | -1.39 | -145.8 | -16.08 | 174.2 |
| 75 | -3.70 | 112.1 | -37.80 | 122.6 | 3.76 | -175.9 | -21.34 | 156.5 |
| 76 | -7.04 | 27.1 | -39.02 | 57.8 | 8.27 | 147.2 | -32.33 | -88.8 |
| 77 | -9.89 | -54.8 | -49.41 | 11.4 | 12.45 | 106.5 | -25.50 | -87.4 |
| 78 | -11.11 | -119.6 | -50.15 | 8.0 | 16.25 | 55.7 | -15.98 | -91.1 |
| 79 | -15.87 | -165.0 | -47.11 | -33.3 | 17.72 | -1.7 | -14.77 | -113.8 |
| 80 | -24.20 | 173.2 | -60.94 | -113.5 | 17.16 | -50.1 | -12.28 | -136.7 |
| 81 | -28.72 | -99.1 | -51.00 | -67.4 | 16.38 | -88.2 | -12.32 | -152.4 |
| 82 | -21.77 | -98.6 | -48.05 | -109.3 | 16.01 | -121.7 | -13.09 | -159.2 |
| 83 | -18.19 | -113.9 | -53.75 | -119.6 | 16.13 | -154.9 | -11.89 | -171.9 |
| 84 | -16.98 | -118.1 | -52.54 | -161.8 | 16.20 | 174.3 | -12.21 | 171.4 |
| 85 | -15.21 | -135.4 | -51.74 | 146.8 | 16.85 | 141.8 | -13.98 | 156.7 |
| 86 | -15.61 | -154.4 | -52.07 | 103.4 | 17.06 | 107.0 | -15.12 | 152.8 |
| 87 | -16.28 | -162.2 | -55.59 | -10.9 | 16.60 | 73.6 | -15.11 | 154.1 |
| 88 | -16.82 | -172.6 | -63.41 | -173.6 | 16.54 | 44.6 | -15.99 | 144.6 |
| 89 | -17.77 | 174.3 | -59.12 | 100.7 | 16.46 | 14.0 | -16.01 | 138.5 |
| 90 | -20.16 | 162.6 | -56.99 | 37.3 | 16.26 | -16.5 | -15.98 | 127.1 |
| 91 | -23.37 | 160.8 | -58.98 | -48.2 | 16.21 | -45.1 | -17.49 | 117.1 |
| 92 | -25.07 | 174.8 | -63.88 | 42.0 | 16.53 | -73.5 | -18.31 | 108.2 |
| 93 | -27.83 | -176.8 | -49.55 | 15.8 | 16.66 | -103.9 | -18.51 | 99.7 |
| 94 | -24.20 | -142.3 | -45.20 | -14.8 | 16.88 | -132.6 | -23.35 | 82.7 |
| 95 | -19.58 | -159.9 | -44.79 | -51.8 | 17.43 | -163.4 | -27.83 | 119.0 |
| 96 | -19.07 | 169.2 | -47.08 | -78.6 | 17.66 | 160.9 | -20.18 | 121.6 |
| 97 | -20.34 | 148.5 | -47.05 | -86.8 | 17.19 | 127.5 | -20.52 | 105.7 |
| 98 | -21.08 | 132.2 | -46.64 | -96.8 | 16.74 | 97.5 | -20.30 | 83.3 |
| 99 | -20.56 | 115.6 | -46.80 | -89.2 | 16.54 | 69.0 | -21.28 | 67.8 |
| 100 | -19.37 | 85.3 | -43.63 | -90.3 | 17.19 | 41.0 | -28.63 | -10.1 |
| 101 | -18.31 | 52.3 | -41.25 | -106.8 | 17.51 | 4.7 | -28.04 | 164.1 |
| 102 | -16.68 | 28.0 | -40.83 | -125.1 | 17.32 | -29.6 | -21.86 | 121.9 |
| 103 | -14.47 | 1.7 | -43.05 | -142.1 | 17.12 | -62.6 | -22.99 | 113.3 |
| 104 | -13.45 | -28.5 | -41.39 | -138.6 | 17.38 | -94.2 | -22.85 | 74.3 |
| 105 | -13.48 | -46.5 | -40.08 | -150.1 | 17.99 | -129.8 | -30.09 | 105.1 |
| 106 | -12.52 | -54.9 | -40.47 | -165.1 | 18.53 | -169.5 | -28.68 | 173.0 |
| 107 | -11.21 | -72.6 | -41.80 | -163.4 | 19.12 | 146.3 | -20.32 | 169.1 |
| 108 | -11.12 | -84.1 | -39.92 | 175.3 | 19.28 | 91.4 | -12.90 | 138.1 |
| 109 | -9.82 | -90.7 | -36.78 | 173.2 | 16.28 | 29.9 | -10.74 | 106.6 |
| 110 | -8.67 | -109.5 | -36.82 | 159.6 | 12.41 | -8.0 | -10.66 | 76.0 |

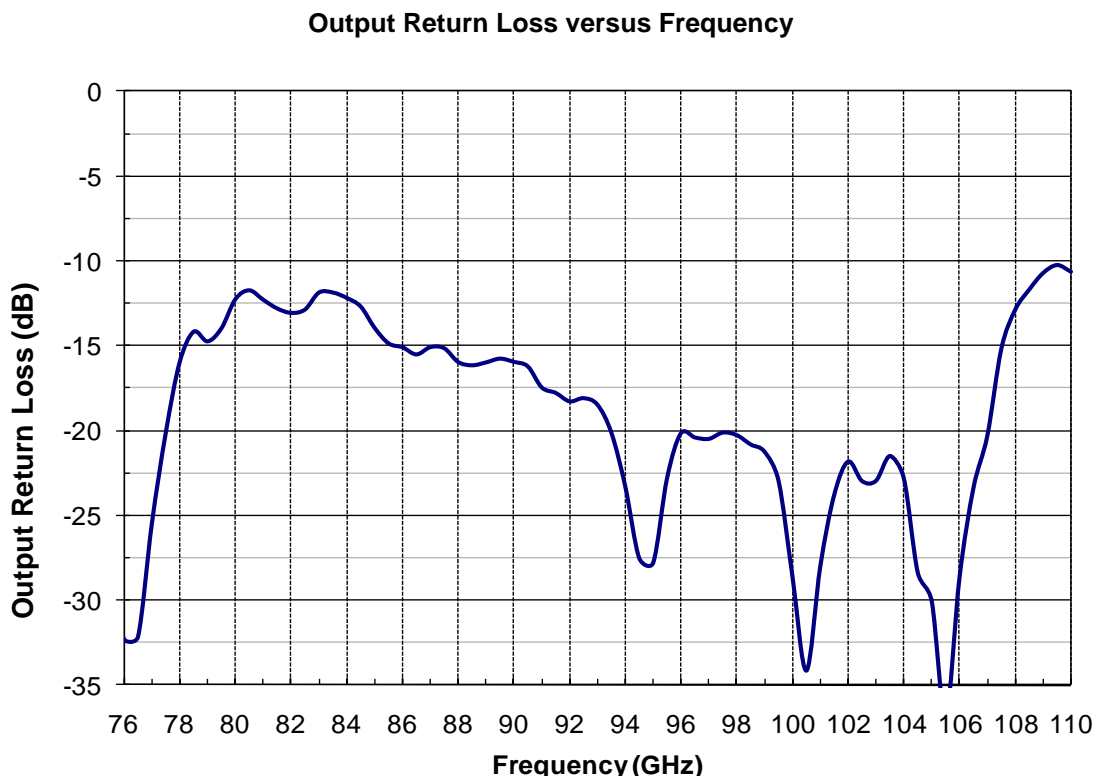
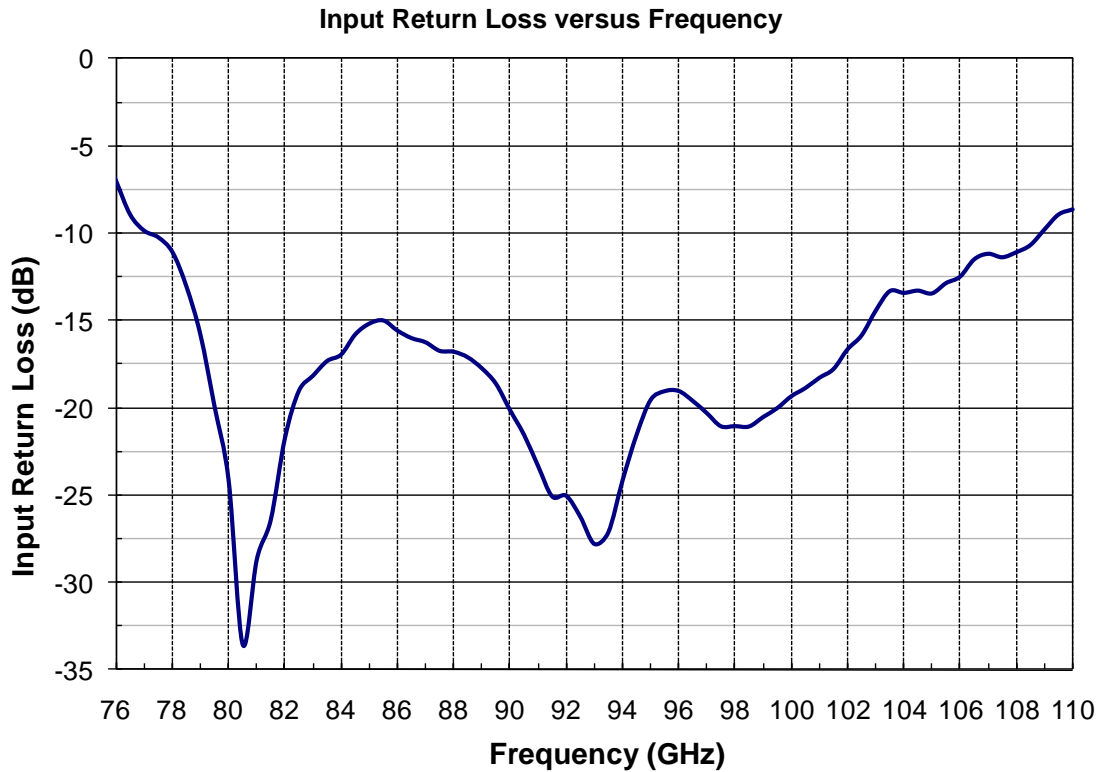
Typical On wafer Measurements

Tamb.= +25°C, VD = 2.5V, ID = 115mA



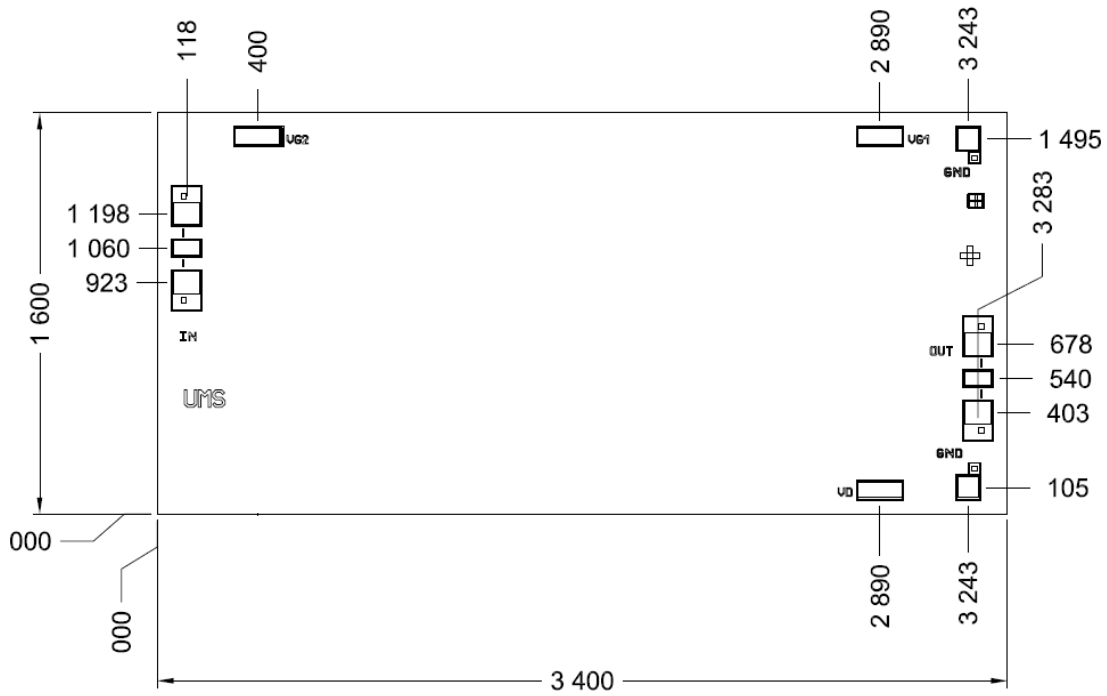
Typical On wafer Measurements

Tamb.= +25°C, VD = 2.5V, ID = 115mA



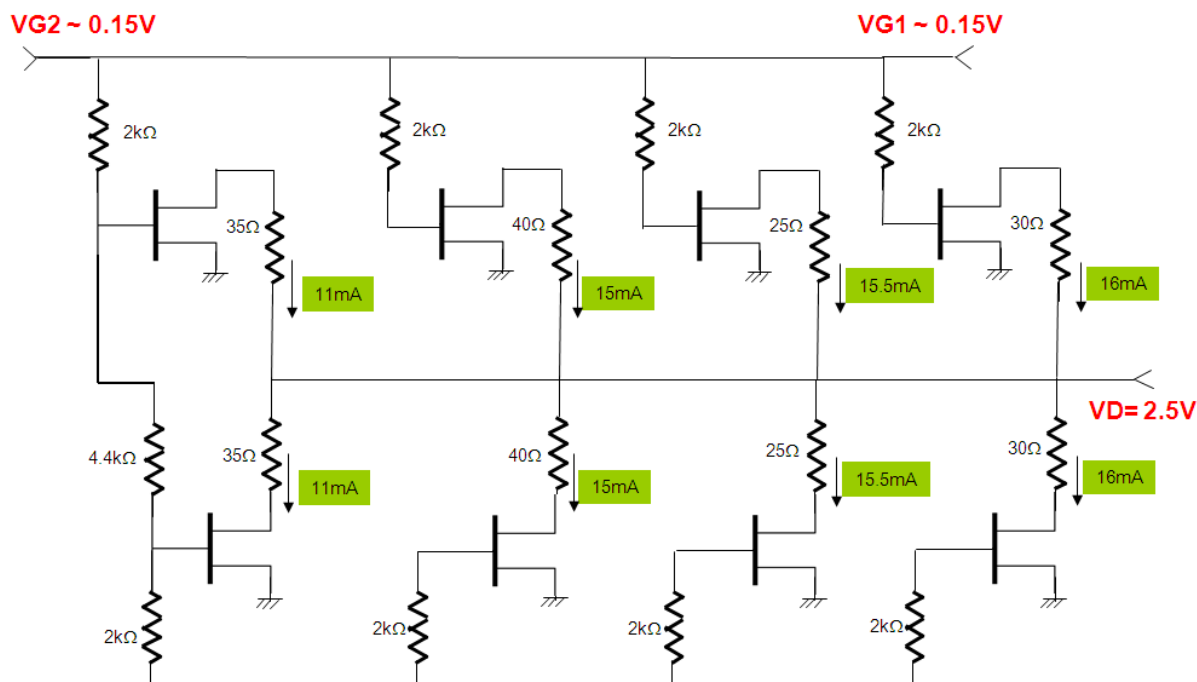
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Mechanical data



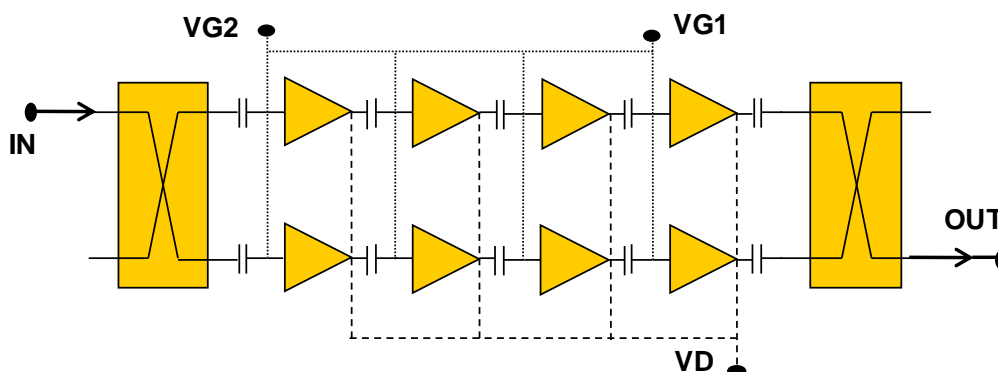
Chip thickness: 70 μ m
DC pad size: 190x80 μ m
RF pad size: 122x72 μ m
Chip size: 3400x1600 \pm 35 μ m
All dimensions are in micrometers

DC Schematic



Notes

VD supply voltage is common for the 4 stages of the amplifier.
 VG1 and VG2 pads are linked in the circuit so the gate supply voltage can be apply either on VG1 or VG2.



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.

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>.

Ordering Information

Chip form: CHA1008-99F/00

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