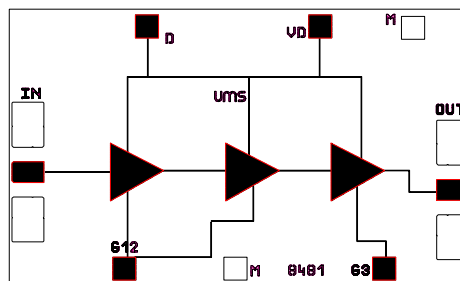


36-44GHz Low Noise Amplifier Self biased GaAs Monolithic Microwave IC

Description

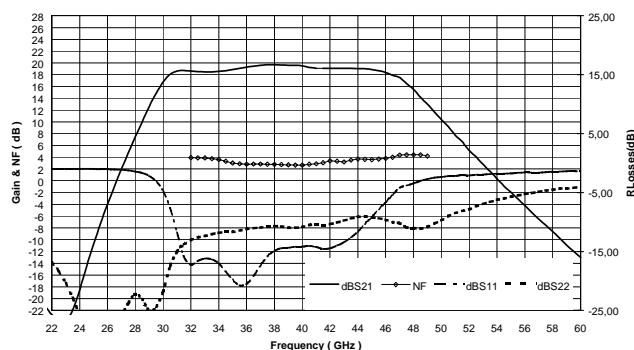
The circuit is a three-stage self biased wide band monolithic low noise amplifier, designed for 36GHz to 44GHz point to point and point to multipoint communication .

The circuit is manufactured with a standard HEMT process : 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.
It is supplied in chip form.



Main Feature

- Broad band performance 36-44GHz
- 3dB noise figure
- 19dB gain, ± 0.5dB gain flatness
- Low DC power consumption, 45mA
- 20dBm 3rd order intercept point
- Chip size : 1.670 x 0.970x 0.1mm



Main Characteristics

Tamb = +25°C

On wafer typical measurement

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|------------------------------|-----|-------|-----|------|
| NF | Noise figure at freq : 40GHz | | 3 | 4 | dB |
| G | Gain | 17 | 19 | | dB |
| ΔG | Gain flatness | | ± 0.5 | ± 1 | dB |

ESD Protections : Electrostatic discharge sensitive device observe handling precautions !

Electrical Characteristics

Tamb = +25°C, Vd = +3,5V (On wafer)

| Symbol | Parameter | Min | Typ | Max | Unit |
|------------|--------------------------------------|-----|-----------|---------|------|
| Fop | Operating frequency range | 36 | | 44 | Ghz |
| G | Gain (1) | 17 | 19 | | dB |
| ΔG | Gain flatness (1) | | ± 0.5 | ± 1 | dB |
| NF | Noise figure (1) (freq: 36-40 GHz) | | 3 | 4 | dB |
| VSWRin | Input VSWR (1) | | 2.5:1 | 3.0:1 | |
| VSWRout | Output VSWR (1) | | 2.5:1 | 3.0:1 | |
| IP3 | 3rd order intercept point | | 20 | | dBm |
| P1dB | Output power at 1dB gain compression | 8 | 10 | | dBm |
| Id | Drain bias current (2) | | 45 | 75 | mA |

(1) These values are representative of wafer measurements without bonding wire at the RF ports.

(2) This current is the typical value for low noise and low current consumption biasing :
Vd=3.5V , Vg12 and Vg3 not connected.

Absolute Maximum Ratings (3)

Tamb = +25°C

| Symbol | Parameter | Values | Unit |
|--------|--|-------------|------|
| Vd | Drain bias voltage (5) | 4 | V |
| Vg | Vg12 and Vg3 max | +1 | V |
| Id | Drain current | 75 | mA |
| Pin | Maximum peak input power overdrive (4) | 15 | dBm |
| Top | Operating temperature range | -40 to +85 | °C |
| Tstg | Storage temperature range | -55 to +125 | °C |

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

(4) Duration < 1s.

(5) See chip biasing options page 9

Typical Result**Chip Typical Response (On wafer Scattering parameters) :**

Tamb = +25°C Vd=3.5V Id=+42mA

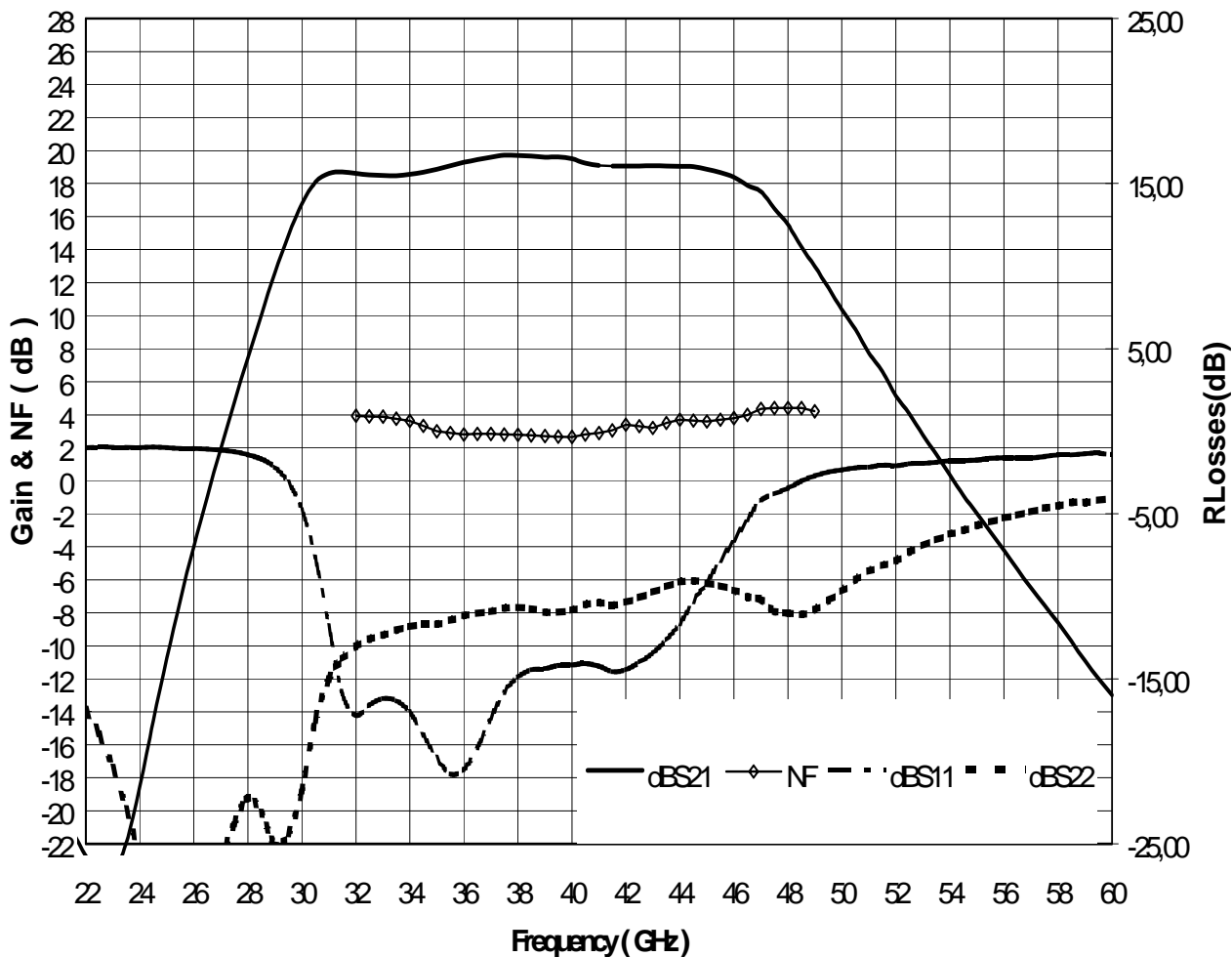
| F(GHz) | S11 | | S12 | | S21 | | S22 | |
|--------|--------|---------|--------|---------|--------|---------|--------|---------|
| | mod | Pha | mod | Pha | mod | Pha | mod | Pha |
| | dB | deg | dB | deg | dB | deg | dB | deg |
| 2,00 | -4,39 | -56,73 | -75,42 | 44,36 | -37,71 | 179,84 | -0,11 | -26,01 |
| 4,00 | -3,92 | -86,19 | -68,73 | -0,07 | -38,99 | 144,86 | -0,41 | -51,53 |
| 6,00 | -3,01 | -111,00 | -68,42 | -40,89 | -38,00 | 82,75 | -0,87 | -75,92 |
| 8,00 | -2,33 | -132,18 | -62,78 | -61,43 | -31,40 | -24,55 | -1,53 | -98,47 |
| 10,00 | -1,87 | -149,64 | -58,07 | -92,78 | -22,10 | -68,40 | -2,33 | -120,41 |
| 12,00 | -1,57 | -164,59 | -54,16 | -118,46 | -15,19 | -121,90 | -3,50 | -140,34 |
| 14,00 | -1,35 | -177,94 | -51,89 | -167,25 | -11,48 | -177,68 | -4,77 | -158,48 |
| 16,00 | -1,25 | 169,65 | -52,93 | 158,44 | -10,44 | 129,48 | -6,27 | -176,02 |
| 18,00 | -1,16 | 157,50 | -51,04 | 165,85 | -11,48 | 84,35 | -8,13 | 163,01 |
| 20,00 | -1,09 | 144,51 | -49,77 | 164,40 | -15,47 | 49,64 | -12,66 | 138,91 |
| 22,00 | -1,01 | 130,06 | -48,14 | 114,15 | -22,72 | 64,72 | -16,87 | 134,36 |
| 24,00 | -0,99 | 113,68 | -47,48 | 73,88 | -18,51 | 144,50 | -25,93 | 129,23 |
| 25,00 | -1,00 | 104,41 | -48,97 | 61,97 | -10,74 | 152,58 | -35,08 | 177,75 |
| 26,00 | -1,05 | 93,20 | -48,69 | 52,80 | -4,00 | 142,49 | -27,71 | -121,39 |
| 27,00 | -1,15 | 80,32 | -48,51 | 18,34 | 1,96 | 125,50 | -25,75 | -116,09 |
| 28,00 | -1,42 | 63,49 | -49,95 | 6,77 | 7,45 | 100,83 | -22,24 | -115,84 |
| 29,00 | -2,17 | 40,77 | -47,16 | -37,23 | 12,59 | 70,07 | -25,05 | -110,45 |
| 30,00 | -4,74 | 10,16 | -44,24 | -94,27 | 16,78 | 28,35 | -21,79 | -68,00 |
| 31,00 | -11,78 | -12,14 | -41,60 | -147,89 | 18,62 | -19,04 | -15,03 | -77,79 |
| 32,00 | -17,20 | 17,23 | -41,18 | 175,51 | 18,62 | -57,49 | -13,03 | -96,11 |
| 33,00 | -16,20 | 20,67 | -41,81 | 148,47 | 18,49 | -87,41 | -12,36 | -107,46 |
| 34,00 | -17,00 | -2,28 | -39,78 | 125,02 | 18,57 | -113,67 | -11,84 | -116,00 |
| 35,00 | -19,78 | -48,40 | -39,87 | 112,63 | 18,87 | -138,52 | -11,68 | -122,31 |
| 36,00 | -20,49 | -119,64 | -39,25 | 98,45 | 19,30 | -164,01 | -11,17 | -127,64 |
| 37,00 | -17,37 | -175,00 | -37,96 | 86,45 | 19,60 | 170,44 | -10,94 | -133,38 |
| 38,00 | -14,90 | 148,19 | -36,53 | 76,61 | 19,70 | 143,82 | -10,68 | -140,12 |
| 39,00 | -14,38 | 119,40 | -35,30 | 57,46 | 19,60 | 118,71 | -10,97 | -145,87 |
| 40,00 | -14,17 | 99,78 | -33,63 | 38,26 | 19,51 | 94,31 | -10,84 | -148,12 |
| 41,00 | -14,23 | 81,41 | -33,70 | 20,37 | 19,12 | 70,56 | -10,39 | -154,43 |
| 42,00 | -14,45 | 68,04 | -32,62 | 5,49 | 19,06 | 46,84 | -10,36 | -159,30 |
| 43,00 | -13,44 | 54,31 | -32,01 | -15,03 | 19,10 | 22,80 | -9,76 | -166,74 |
| 44,00 | -11,65 | 37,44 | -31,08 | -35,85 | 19,06 | -3,12 | -9,13 | 178,41 |
| 45,00 | -9,14 | 15,96 | -30,72 | -59,51 | 18,88 | -30,61 | -9,22 | 158,00 |
| 46,00 | -6,61 | -8,98 | -31,56 | -86,95 | 18,39 | -60,43 | -9,63 | 130,78 |
| 47,00 | -4,21 | -34,87 | -33,12 | -117,26 | 17,52 | -91,46 | -10,19 | 94,17 |
| 48,00 | -3,45 | -62,16 | -35,95 | -136,86 | 15,52 | -122,46 | -11,03 | 49,86 |
| 49,00 | -2,71 | -84,52 | -37,02 | -153,94 | 13,00 | -148,98 | -10,81 | 7,88 |
| 50,00 | -2,35 | -102,45 | -38,27 | 165,40 | 10,38 | -171,73 | -9,71 | -23,44 |

Typical Results

Chip Typical Response (On wafer Scattering parameters) :

Tamb = +25°C

Vd = 3.5V Vg12& Vg3 not connected; Id = 42mA



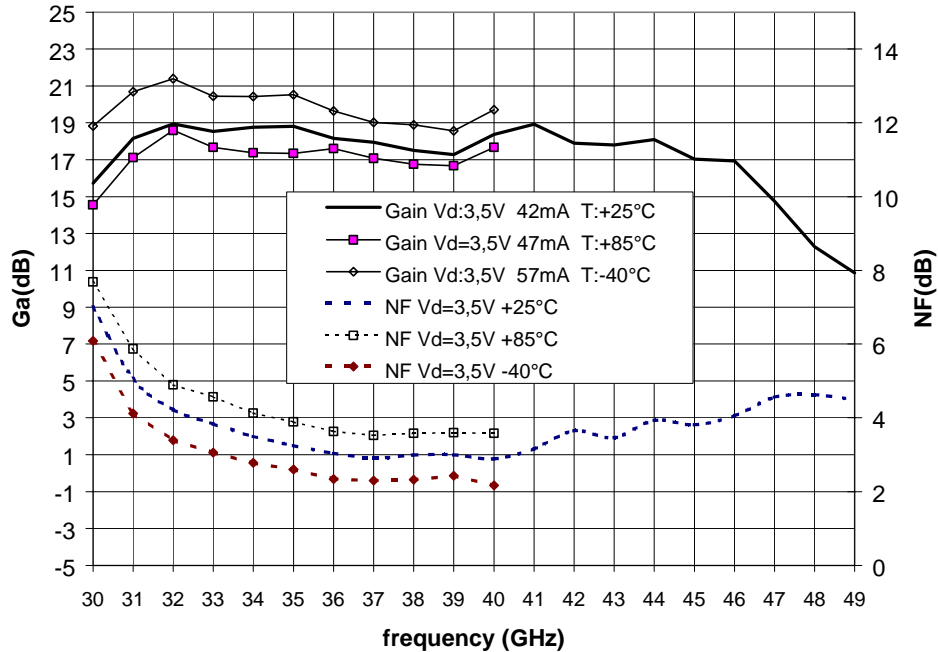
Typical Gain , Matching and Noise Figure (Measurements on wafer.)

Typical Results

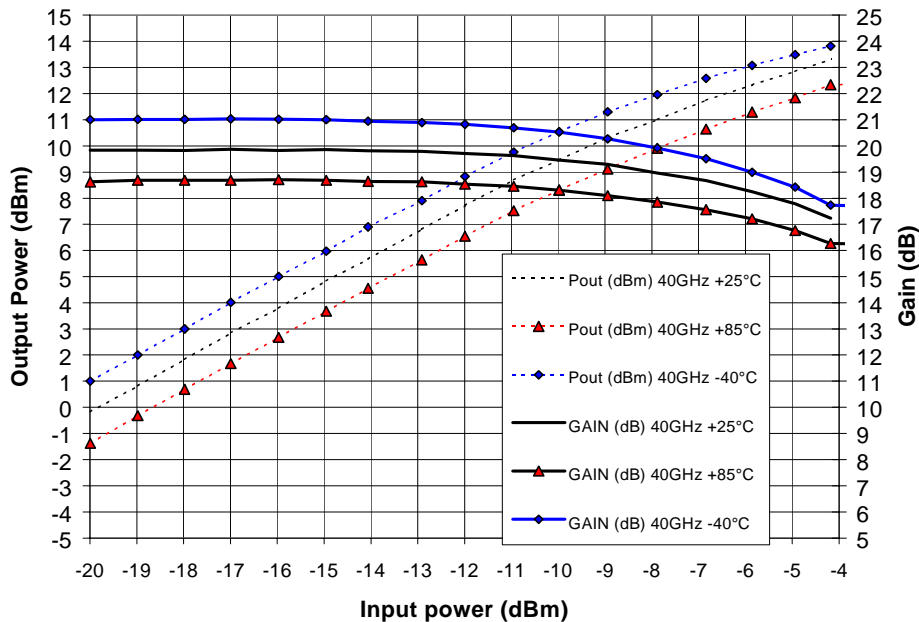
Chip Typical Response (In test JIG)

Vd = 3.5V Vg12& Vg3 not connected; Id = 42mA

Typical gain slope versus temperature : -0.025dB/°C
 Typical noise figure slope versus temperature : 0.011dB/°C

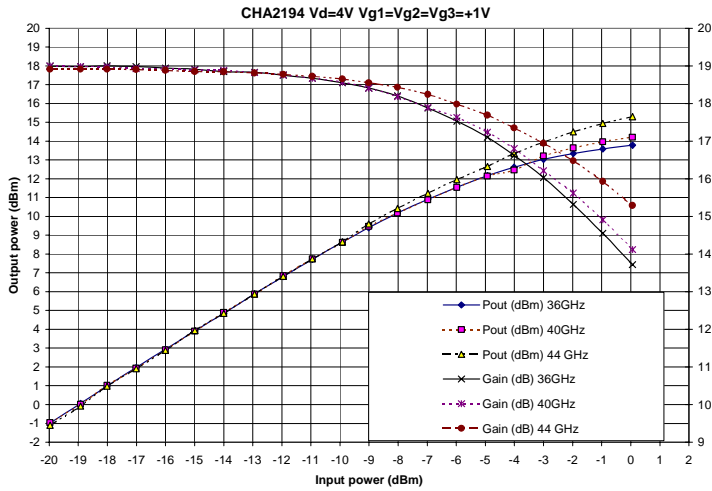


Typical Gain and NF versus temperature (measurements in test jig)



Typical Gain & Pout versus temperature (measurements in test-jig)

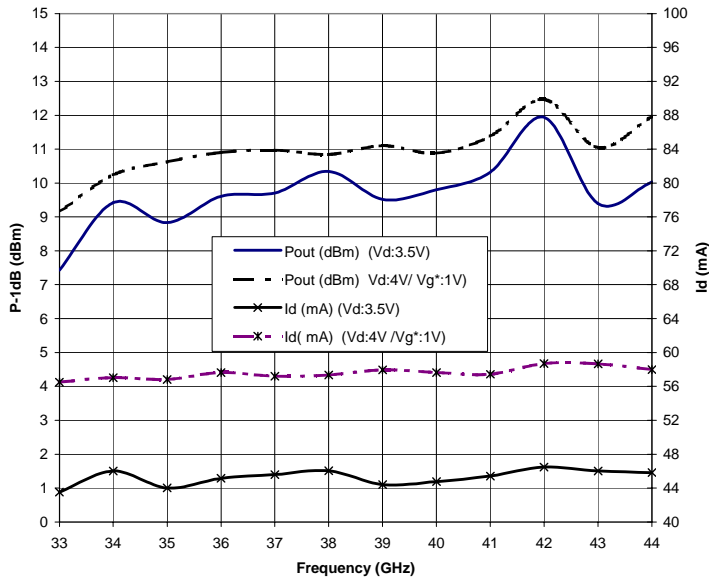
Circuit Typical Response (In test-Jig) :



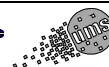
Typical Output Power (Measurement in test Jig)

Tamb = +25°C Vd=4V and Vg12=Vg3=1V

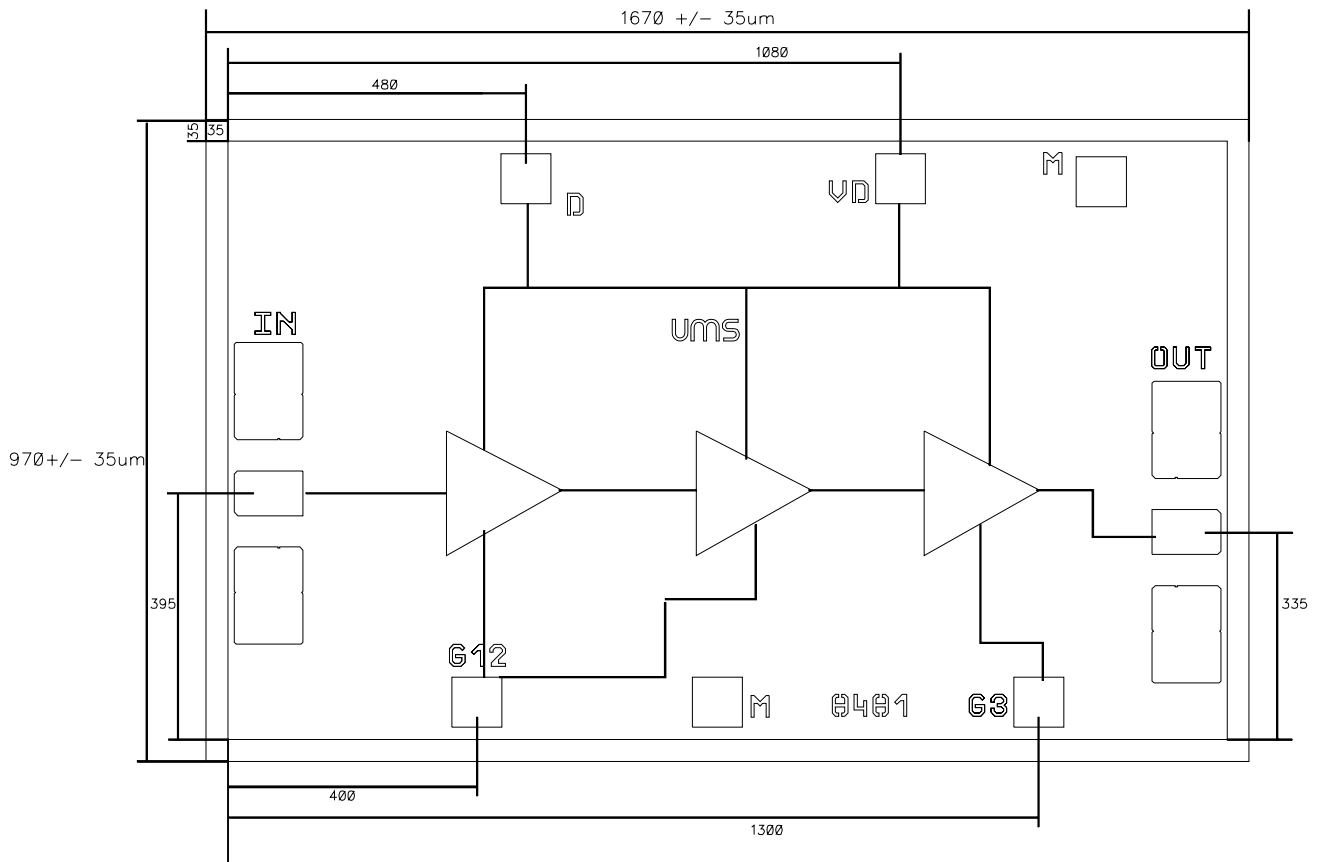
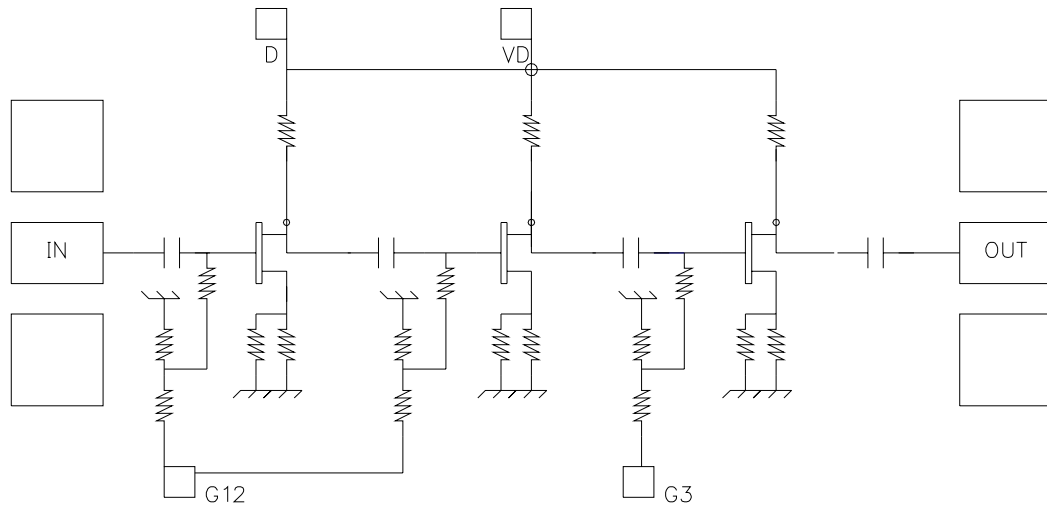
These values are representative of the package assembly with input and output bonding.



Typical Output power -1dB. (Measurement in test Jig)

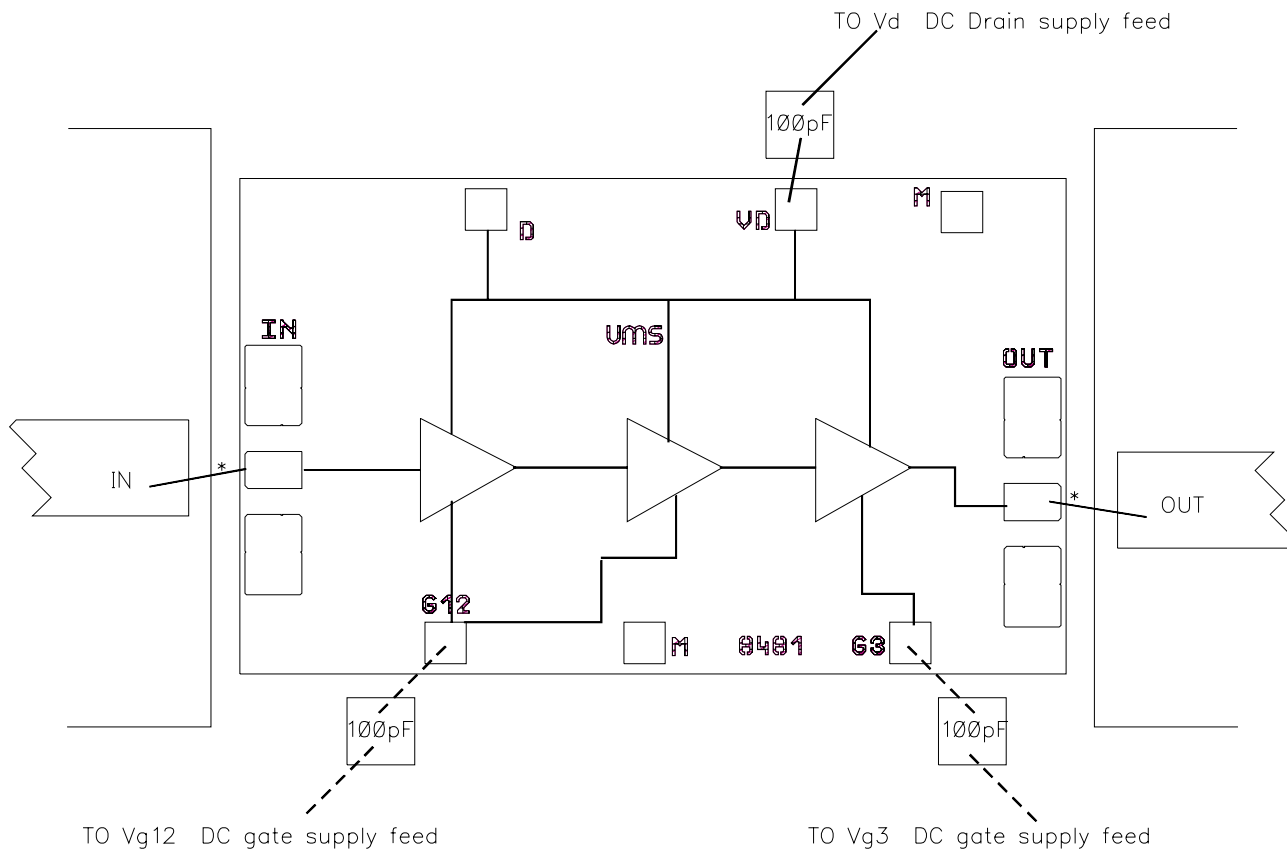


Chip schematic and Pad Identification (see also page 9)



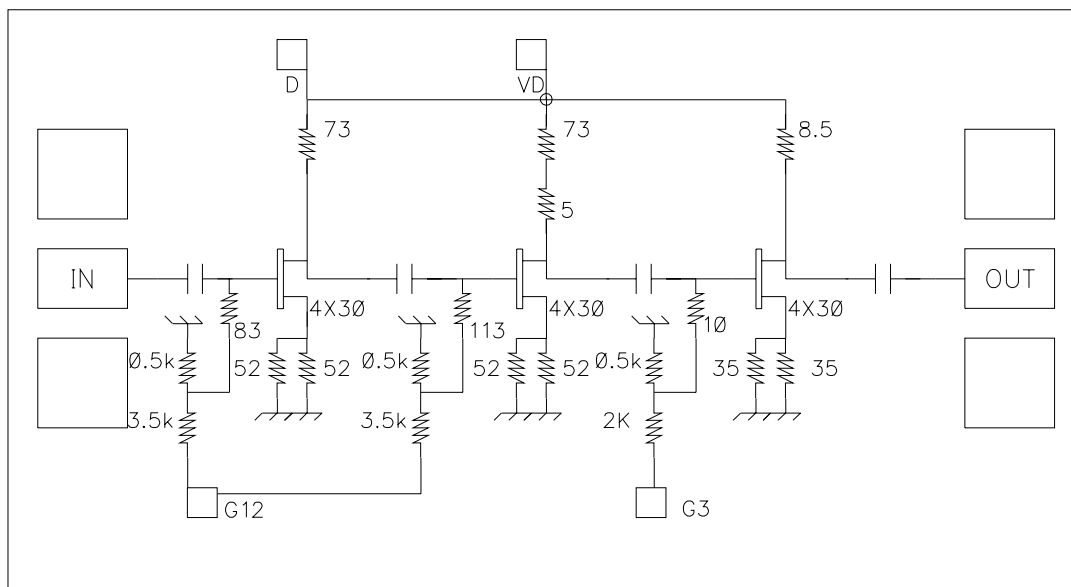
Pad Size :80/80μm, chip thickness 100μm
 Dimensions : 1670μm x 970μm ± 35μm

Typical Chip Assembly



- * Nominal Input and Output bonding length :0.3 to 0.38nH for one 25μm bond wire.
- Chip backside is DC and RF bonding grounded

Chip Biasing options



Internal DC schematic

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

Absolute recommendations:

N°1 : Do not exceed $V_{ds}^* = 3,5$ Volt (internal Drain to Source voltage).

N°2 : Do not bias in such a way that V_{gs}^* becomes positive. (:internal Gate to Source voltage)

Typical biasing table and Typical results in test Jig at 40 GHz

| 40GHz IN TEST Jig | V_{ds} (V) | V_{g12} (V) | V_{g3} (V) | I_d (mA) | Typical NF(dB) | Typical Gain (dB) | Typical P-1dB (dB) | Typical Psat (dB) |
|---|----------------|-----------------|----------------|--------------|----------------|-------------------|--------------------|-------------------|
| Standard | 3.5 | NC | NC | 42 | 2,9 | 19 | 10 | 12 |
| Low Noise High linearity | 4 | 1 | 1 | 60 | 2,95 | 20 | 11 | 14 |
| Low noise /low current consumption | 3.5 | -1 | -1 | 30 | 3 | 17,5 | 8 | 11 |
| Switch off | 3.5 | -8 | -5 | 0 | X | X | X | X |

Ordering Information

Chip form : CHA2194-99F/00

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