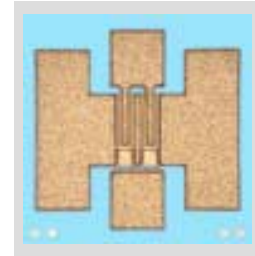


## Super Low Noise GaAs FETs

### FEATURES

- Low Noise Figure: NF = 0.5 dB Typical at 12 GHz
- High Associated Gain: Ga = 12 dB Typical at 12 GHz
- $L_g = 0.25 \mu\text{m}$ ,  $W_g = 300 \mu\text{m}$
- All-Gold Metallization for High Reliability
- Tight  $V_p$  ranges control
- High RF input power handling capability
- 100 % DC Tested

### PHOTO ENLARGEMENT



### DESCRIPTION

The TC1202 is a GaAs Pseudomorphic High Electron Mobility Transistor (PHEMT) chip, which has very low noise figure and high associated gain. The device can be used in circuits up to 30 GHz and suitable for low noise application including a wide range of commercial and military applications. All devices are 100% DC tested to assure consistent quality. All bond pads are gold plated for either thermo-compression or thermo-sonic wire bonding.

### ELECTRICAL SPECIFICATIONS ( $T_A=25^\circ\text{C}$ )

| Symbol     | Conditions  | MIN | TYP  | MAX | UNIT               |
|------------|---|-----|------|-----|--------------------|
| NF         | Noise Figure at $V_{DS} = 4 \text{ V}$ , $I_{DS} = 25 \text{ mA}$ , $f = 12\text{GHz}$    |     | 0.5  | 0.7 | dB                 |
| $G_a$      | Associated Gain at $V_{DS} = 4 \text{ V}$ , $I_{DS} = 25 \text{ mA}$ , $f = 12\text{GHz}$ | 11  | 12   |     | dB                 |
| $I_{DSS}$  | Saturated Drain-Source Current at $V_{DS} = 2 \text{ V}$ , $V_{GS} = 0 \text{ V}$         |     | 90   |     | mA                 |
| $g_m$      | Transconductance at $V_{DS} = 2 \text{ V}$ , $V_{GS} = 0 \text{ V}$                       |     | 100  |     | mS                 |
| $V_p$      | Pinch-off Voltage at $V_{DS} = 2 \text{ V}$ , $I_D = 0.6 \text{ mA}$                      |     | -1.0 |     | Volts              |
| $BV_{DGO}$ | Drain-Gate Breakdown Voltage at $I_{DGO} = 0.15 \text{ mA}$                               | 5   | 8    |     | Volts              |
| $R_{th}$   | Thermal Resistance  |     | 120  |     | $^\circ\text{C/W}$ |

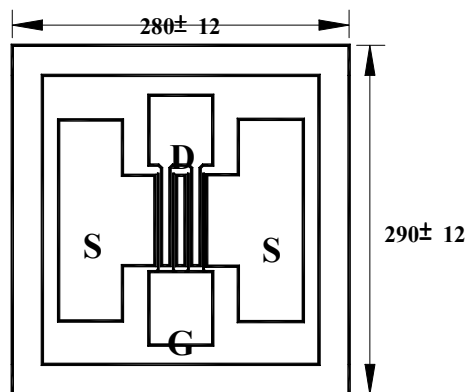
**Note:** \* For the tight control of the pinch-off voltage . TC1202's are divided into 3 groups:

- (1) **TC1202P0710** :  $V_p = -0.7\text{V}$  to  $-1.0\text{V}$  (2) **TC1202P0811** :  $V_p = -0.8\text{V}$  to  $-1.1\text{V}$  (3) **TC1202P0912** :  $V_p = -0.9\text{V}$  to  $-1.2\text{V}$   
 In addition, the customers may specify their requirements.

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25 °C) TYPICAL NOISE PARAMETERS (T<sub>A</sub>=25 °C)**

 V<sub>DS</sub> = 4 V, I<sub>DS</sub> = 25 mA

| Symbol           | Parameter              | Rating             | Frequency<br>(GHz) | NF <sub>opt</sub><br>(dB) | G <sub>A</sub><br>(dB) | Γ <sub>opt</sub> |     | Rn/50 |
|------------------|------------------------|--------------------|--------------------|---------------------------|------------------------|------------------|-----|-------|
|                  |                        |                    |                    |                           |                        | MAG              | ANG |       |
| V <sub>DS</sub>  | Drain-Source Voltage   | 5 V                | 2                  | 0.31                      | 20.6                   | 0.90             | 10  | 0.64  |
| V <sub>GS</sub>  | Gate-Source Voltage    | -3.0 V             | 4                  | 0.37                      | 17.2                   | 0.81             | 20  | 0.45  |
| I <sub>DS</sub>  | Drain Current          | I <sub>DSS</sub>   | 6                  | 0.41                      | 14.8                   | 0.74             | 37  | 0.35  |
| I <sub>GS</sub>  | Gate Current           | 300 μA             | 8                  | 0.47                      | 13.1                   | 0.69             | 57  | 0.29  |
| P <sub>in</sub>  | RF Input Power, CW     | 20 dBm             | 10                 | 0.52                      | 12.1                   | 0.64             | 77  | 0.24  |
| P <sub>T</sub>   | Continuous Dissipation | 400 mW             | 12                 | 0.58                      | 11.4                   | 0.58             | 95  | 0.20  |
| T <sub>CH</sub>  | Channel Temperature    | 175 °C             | 14                 | 0.71                      | 10.8                   | 0.55             | 113 | 0.16  |
| T <sub>STG</sub> | Storage Temperature    | - 65 °C to +175 °C | 16                 | 0.88                      | 10.4                   | 0.52             | 130 | 0.11  |
|                  |                        |                    | 18                 | 1.04                      | 9.9                    | 0.51             | 151 | 0.08  |

**CHIP DIMENSIONS**


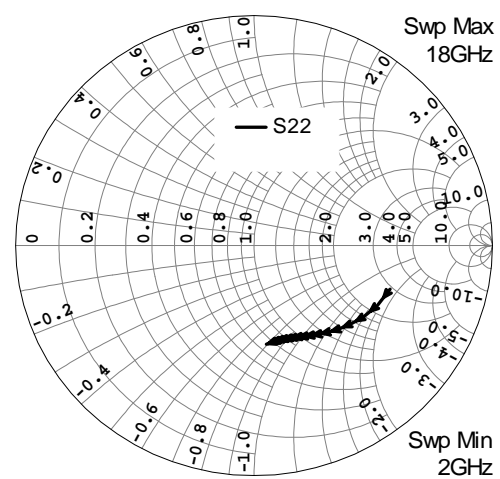
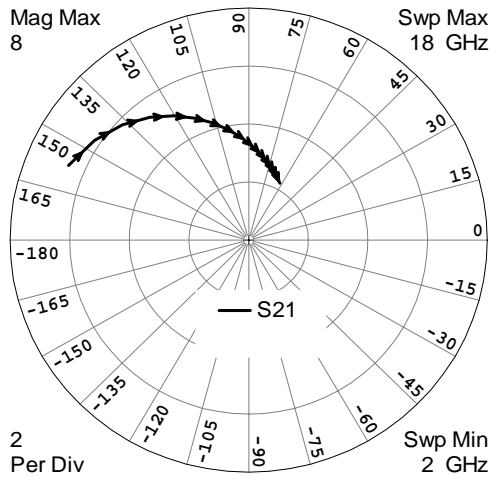
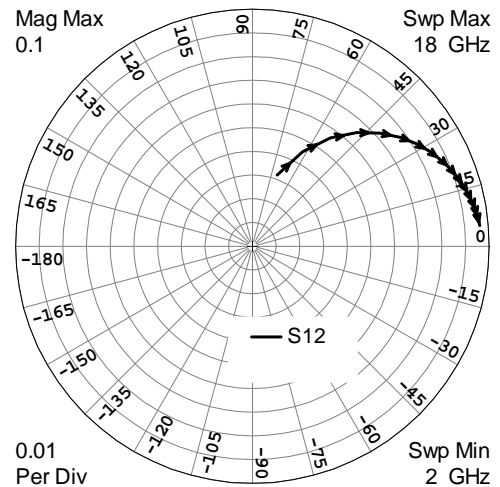
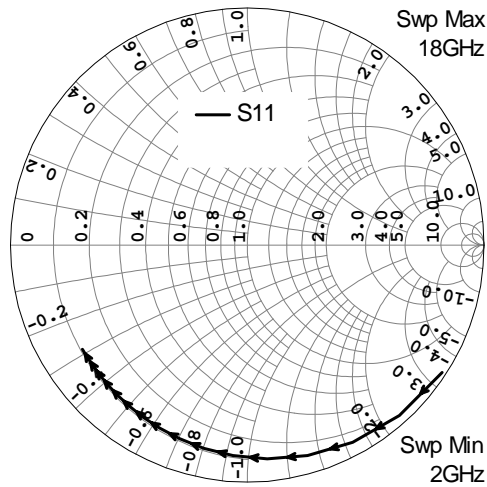
Units: Micrometers

Gate Pad: 55 x 60

Chip Thickness: 100

Drain Pad: 55 x 60

Source Pad: 55 x 169

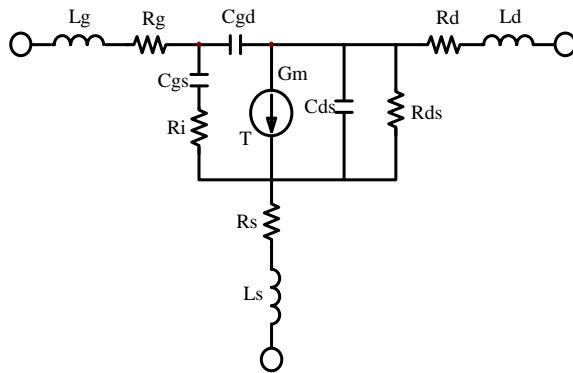
**TYPICAL SCATTERING PARAMETERS (T<sub>A</sub>=25 °C) V<sub>DS</sub> = 4 V, I<sub>DS</sub> = 25 mA**


| FREQUENCY<br>(GHz) | S11    |         | S21    |        | S12    |       | S22    |        |
|--------------------|--------|---------|--------|--------|--------|-------|--------|--------|
|                    | MAG    | ANG     | MAG    | ANG    | MAG    | ANG   | MAG    | ANG    |
| 2                  | 0.9823 | -33.16  | 6.5659 | 156.94 | 0.0318 | 70.67 | 0.6019 | -18.38 |
| 3                  | 0.9641 | -48.24  | 6.2124 | 146.39 | 0.0451 | 61.99 | 0.5794 | -26.63 |
| 4                  | 0.9438 | -61.87  | 5.8010 | 136.77 | 0.0562 | 54.23 | 0.5540 | -33.99 |
| 5                  | 0.9239 | -73.98  | 5.3750 | 128.09 | 0.0650 | 47.41 | 0.5288 | -40.46 |
| 6                  | 0.9058 | -84.62  | 4.9624 | 120.28 | 0.0720 | 41.46 | 0.5056 | -46.12 |
| 7                  | 0.8900 | -93.94  | 4.5784 | 113.25 | 0.0775 | 36.28 | 0.4855 | -51.07 |
| 8                  | 0.8766 | -102.10 | 4.2290 | 106.86 | 0.0818 | 31.75 | 0.4687 | -55.44 |
| 9                  | 0.8654 | -109.26 | 3.9151 | 101.02 | 0.0852 | 27.76 | 0.4551 | -59.33 |
| 10                 | 0.8561 | -115.58 | 3.6347 | 95.63  | 0.0878 | 24.22 | 0.4445 | -62.83 |
| 11                 | 0.8485 | -121.18 | 3.3847 | 90.61  | 0.0899 | 21.04 | 0.4367 | -66.01 |
| 12                 | 0.8423 | -126.18 | 3.1617 | 85.91  | 0.0916 | 18.18 | 0.4311 | -68.94 |
| 13                 | 0.8371 | -130.67 | 2.9623 | 81.47  | 0.0929 | 15.57 | 0.4276 | -71.66 |
| 14                 | 0.8329 | -134.73 | 2.7836 | 77.25  | 0.0940 | 13.18 | 0.4259 | -74.21 |
| 15                 | 0.8295 | -138.41 | 2.6227 | 73.22  | 0.0948 | 10.97 | 0.4256 | -76.61 |
| 16                 | 0.8267 | -141.77 | 2.4775 | 69.34  | 0.0955 | 8.92  | 0.4267 | -78.89 |
| 17                 | 0.8245 | -144.86 | 2.3458 | 65.61  | 0.0960 | 7.00  | 0.4289 | -81.07 |
| 18                 | 0.8227 | -147.71 | 2.2260 | 62.00  | 0.0964 | 5.19  | 0.4321 | -83.16 |

\* The data does not include gate, drain and source bond wires.

**SMALL SIGNAL MODEL, V<sub>DS</sub> = 4 V, I<sub>DS</sub> = 25 mA**

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 Web-Site: [www.transcominc.com.tw](http://www.transcominc.com.tw) Phone: 886-6-5050086 Fax: 886-6-5051602

**SCHEMATI**

**PARAMETERS**

|            |           |            |           |
|------------|-----------|------------|-----------|
| <b>Lg</b>  | 0.045 nH  | <b>Rs</b>  | 1.12 Ohm  |
| <b>Rg</b>  | 0.79 Ohm  | <b>Ls</b>  | 0.0005 nH |
| <b>Cgs</b> | 0.361 pF  | <b>Cds</b> | 0.084 pF  |
| <b>Ri</b>  | 1.47 Ohm  | <b>Rds</b> | 193.0 Ohm |
| <b>Cgd</b> | 0.031 pF  | <b>Rd</b>  | 0.920 Ohm |
| <b>Gm</b>  | 94.9 mS   | <b>Ld</b>  | 0.024 nH  |
| <b>T</b>   | 2.13 psec |            |           |

**CHIP HANDLING**

**DIE ATTACHMENT:** Conductive epoxy or eutectic die attach is recommended. Eutectic die attach can be accomplished with Au-Sn (80%Au-20%Sn) perform at stage temperature: 290°C ± 5°C; Handling Tool: Tweezers; Time: less than 1min.

**WIRE BONDING:** The recommended wire bond method is thermocompression bonding with 0.7 to 1.0 mil (0.018 to 0.025 mm) gold wire. Stage temperature: 220°C to 250°C; Bond Tip Temperature: 150°C; Bond Force: 20 to 30 gms depending on size of wire and Bond Tip Temperature.

**HANDLING PRECAUTIONS:** The user must operate in a clean, dry environment. Care should be exercised during handling avoid damage to the devices. Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing. The static discharge must be less than 300V.