



# DATA SHEET

## HETERO JUNCTION FIELD EFFECT TRANSISTOR NE4210S01

### X to Ku BAND SUPER LOW NOISE AMPLIFIER N-CHANNEL HJ-FET

#### DESCRIPTION

The NE4210S01 is a Hetero Junction FET that utilizes the hetero junction to create high mobility electrons. Its excellent low noise and associated gain make it suitable for DBS and another commercial systems.

#### FEATURES

- Super Low Noise Figure & High Associated Gain  
NF = 0.5 dB TYP. Ga = 13.0 dB TYP. @f = 12 GHz
- Gate Length:  $L_g \leq 0.20 \mu\text{m}$
- Gate Width :  $W_g = 160 \mu\text{m}$

#### ORDERING INFORMATION (PLAN)

| Part Number   | Marking | Supplying Form        |
|---------------|---------|-----------------------|
| NE4210S01-T1  | L       | Tape & reel 1 kp/reel |
| NE4210S01-T1B |         | Tape & reel 4 kp/reel |

**Remark** To order evaluation samples, please contact your nearby sales office. (Part number for sample order: NE4210S01-A)

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = +25^\circ\text{C}$ )

| Parameter               | Symbol    | Ratings     | Unit             |
|-------------------------|-----------|-------------|------------------|
| Drain to Source Voltage | $V_{DS}$  | 4.0         | V                |
| Gate to Source Voltage  | $V_{GS}$  | -3.0        | V                |
| Drain Current           | $I_D$     | $I_{DSS}$   | mA               |
| Gate Current            | $I_G$     | 100         | $\mu\text{A}$    |
| Total Power Dissipation | $P_{tot}$ | 165         | mW               |
| Channel Temperature     | $T_{ch}$  | 125         | $^\circ\text{C}$ |
| Storage Temperature     | $T_{stg}$ | -65 to +125 | $^\circ\text{C}$ |

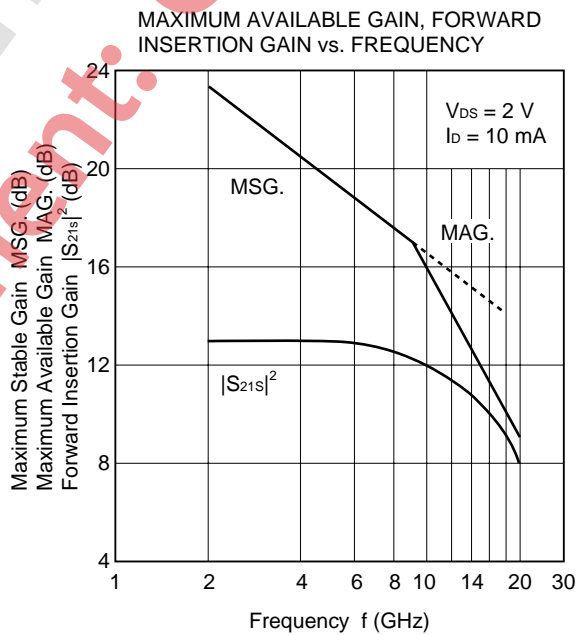
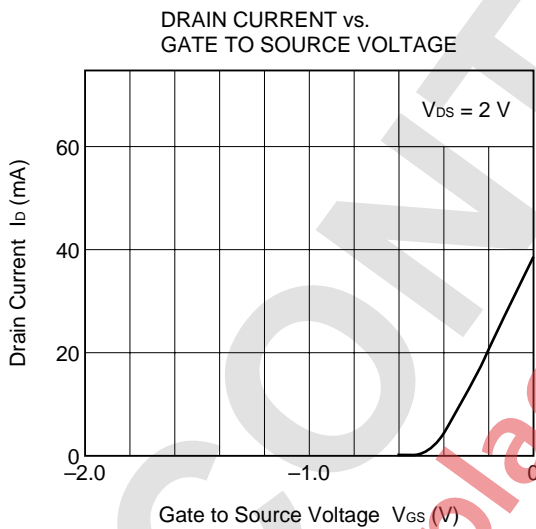
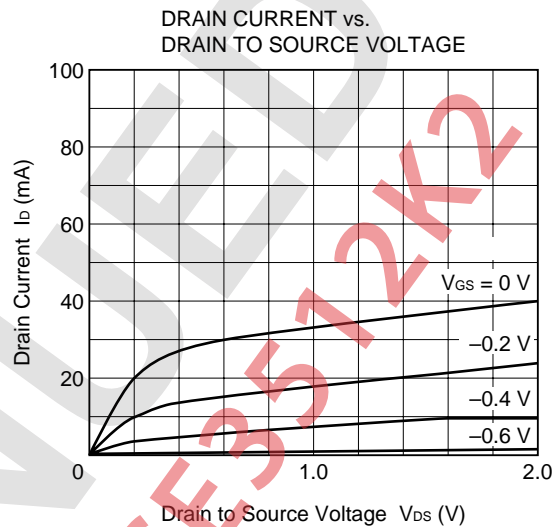
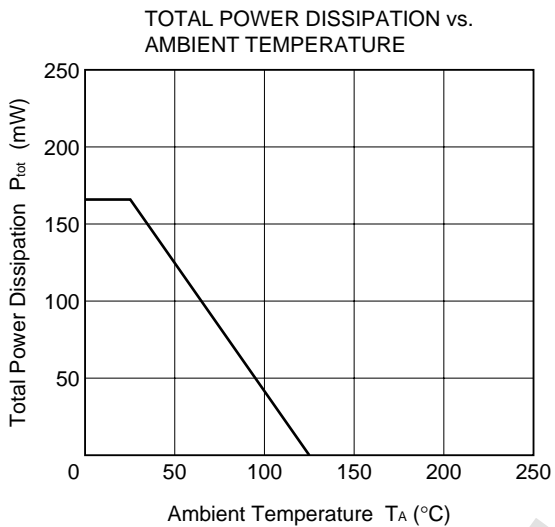
#### RECOMMENDED OPERATING CONDITIONS ( $T_A = +25^\circ\text{C}$ )

| Parameter                 | Symbol   | MIN. | TYP. | MAX. | Unit |
|---------------------------|----------|------|------|------|------|
| ★ Drain to Source Voltage | $V_{DS}$ | 1    | 2    | 3    | V    |
| ★ Drain Current           | $I_D$    | 5    | 10   | 15   | mA   |
| Input Power               | $P_{in}$ | -    | -    | 0    | dBm  |

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25 °C)**

| Parameter                      | Symbol                | Test Conditions                                 | MIN. | TYP. | MAX. | Unit |
|--------------------------------|-----------------------|---|------|------|------|------|
| Gate to Source Leak Current    | I <sub>GSO</sub>      | V <sub>GS</sub> = -3 V                          | -    | 0.5  | 10   | μA   |
| Saturated Drain Current        | I <sub>DSS</sub>      | V <sub>DS</sub> = 2 V, V <sub>GS</sub> = 0 V    | 15   | 40   | 70   | mA   |
| Gate to Source Cut off Voltage | V <sub>GS (off)</sub> | V <sub>DS</sub> = 2 V, I <sub>DS</sub> = 100 μA | -0.2 | -0.7 | -2.0 | V    |
| Transconductance               | g <sub>m</sub>        | V <sub>DS</sub> = 2 V, I <sub>DS</sub> = 10 mA  | 40   | 55   | -    | mS   |
| Noise Figure                   | NF                    | V <sub>DS</sub> = 2 V, I <sub>DS</sub> = 10 mA  | -    | 0.50 | 0.70 | dB   |
| Associated Gain                | G <sub>a</sub>        | f = 12 GHz                                      | 11.0 | 13.0 | -    | dB   |

TYPICAL CHARACTERISTICS ( $T_A = +25\text{ }^\circ\text{C}$ )

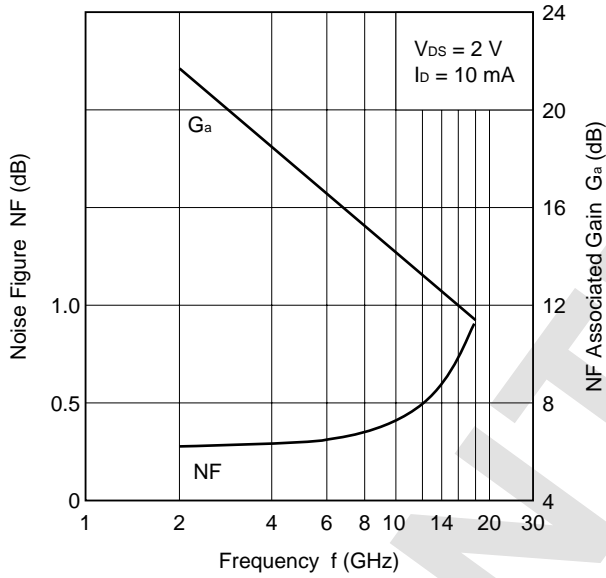


Gain Calculations

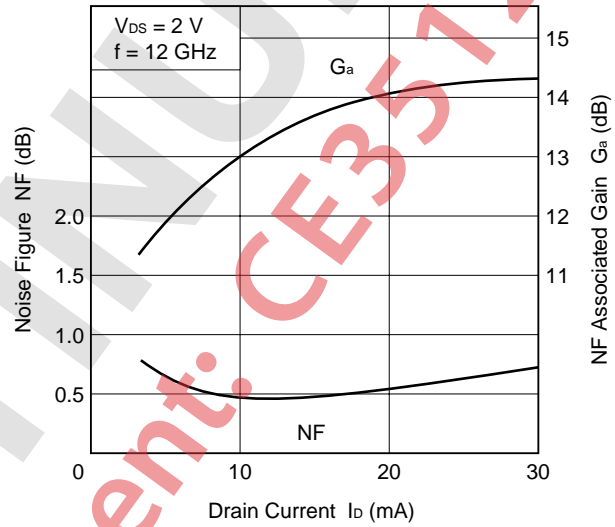
$$\text{MSG.} = \left| \frac{S_{21}}{S_{12}} \right| \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}$$

$$\text{MAG.} = \left| \frac{S_{21}}{S_{12}} \right| (k \pm \sqrt{k^2 - 1}) \quad \Delta = S_{11} \cdot S_{22} - S_{21} \cdot S_{12}$$

NOISE FIGURE, NF ASSOCIATED GAIN vs. FREQUENCY



NOISE FIGURE, NF ASSOCIATED GAIN vs. DRAIN CURRENT



**S-PARAMETERS  
MAG. AND ANG.**

V<sub>DS</sub> = 2 V, I<sub>D</sub> = 10 mA

| FREQUENCY<br>MHz | S <sub>11</sub> |        | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |        |
|------------------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
|                  | MAG.            | ANG.   | MAG.            | ANG.  | MAG.            | ANG.  | MAG.            | ANG.   |
| 2000.0000        | 0.972           | -21.0  | 4.436           | 153.9 | 0.026           | 73.8  | 0.621           | -16.6  |
| 2500.0000        | 0.953           | -27.3  | 4.435           | 147.1 | 0.033           | 69.6  | 0.610           | -21.6  |
| 3000.0000        | 0.934           | -34.1  | 4.443           | 139.9 | 0.039           | 63.7  | 0.592           | -27.1  |
| 3500.0000        | 0.910           | -40.2  | 4.385           | 132.9 | 0.044           | 60.0  | 0.579           | -32.2  |
| 4000.0000        | 0.887           | -45.8  | 4.306           | 126.3 | 0.047           | 54.4  | 0.564           | -37.2  |
| 4500.0000        | 0.865           | -51.1  | 4.244           | 120.0 | 0.051           | 50.2  | 0.554           | -41.6  |
| 5000.0000        | 0.842           | -55.5  | 4.164           | 114.1 | 0.054           | 46.6  | 0.546           | -45.5  |
| 5500.0000        | 0.821           | -60.0  | 4.129           | 108.3 | 0.057           | 42.8  | 0.538           | -49.4  |
| 6000.0000        | 0.802           | -64.8  | 4.122           | 102.6 | 0.061           | 40.6  | 0.531           | -52.1  |
| 6500.0000        | 0.777           | -70.2  | 4.151           | 96.5  | 0.067           | 37.6  | 0.519           | -56.5  |
| 7000.0000        | 0.732           | -76.4  | 4.175           | 89.8  | 0.071           | 33.0  | 0.495           | -60.5  |
| 7500.0000        | 0.685           | -83.4  | 4.179           | 82.9  | 0.073           | 28.7  | 0.460           | -63.9  |
| 8000.0000        | 0.652           | -91.3  | 4.184           | 76.2  | 0.077           | 25.6  | 0.423           | -67.5  |
| 8500.0000        | 0.619           | -100.8 | 4.210           | 69.1  | 0.082           | 23.0  | 0.385           | -72.2  |
| 9000.0000        | 0.591           | -111.0 | 4.189           | 61.5  | 0.086           | 18.0  | 0.344           | -78.5  |
| 9500.0000        | 0.563           | -120.7 | 4.131           | 54.4  | 0.091           | 13.4  | 0.301           | -86.2  |
| 10000.0000       | 0.538           | -129.7 | 4.070           | 47.4  | 0.094           | 10.7  | 0.270           | -95.5  |
| 10500.0000       | 0.517           | -138.8 | 4.023           | 40.3  | 0.099           | 6.5   | 0.250           | -107.2 |
| 11000.0000       | 0.488           | -148.6 | 3.963           | 33.2  | 0.103           | 1.7   | 0.236           | -118.7 |
| 11500.0000       | 0.460           | -158.9 | 3.905           | 26.1  | 0.104           | -2.6  | 0.225           | -127.6 |
| 12000.0000       | 0.433           | -171.3 | 3.850           | 18.5  | 0.108           | -7.1  | 0.215           | -137.8 |
| 12500.0000       | 0.424           | 175.5  | 3.767           | 10.9  | 0.111           | -11.2 | 0.194           | -147.8 |
| 13000.0000       | 0.421           | 161.6  | 3.675           | 3.3   | 0.113           | -16.9 | 0.166           | -161.6 |
| 13500.0000       | 0.436           | 147.9  | 3.551           | -4.2  | 0.112           | -19.9 | 0.144           | 177.6  |
| 14000.0000       | 0.461           | 135.9  | 3.421           | -11.5 | 0.112           | -24.6 | 0.137           | 151.7  |
| 14500.0000       | 0.495           | 125.0  | 3.285           | -18.5 | 0.113           | -28.5 | 0.161           | 127.6  |
| 15000.0000       | 0.528           | 115.2  | 3.151           | -25.9 | 0.111           | -32.0 | 0.210           | 111.3  |
| 15500.0000       | 0.542           | 106.7  | 3.003           | -32.3 | 0.109           | -33.5 | 0.254           | 104.7  |
| 16000.0000       | 0.556           | 99.3   | 2.885           | -39.0 | 0.108           | -37.0 | 0.301           | 101.1  |
| 16500.0000       | 0.561           | 91.0   | 2.764           | -46.4 | 0.107           | -39.4 | 0.347           | 99.3   |
| 17000.0000       | 0.564           | 82.6   | 2.609           | -53.3 | 0.108           | -42.3 | 0.381           | 96.0   |
| 17500.0000       | 0.571           | 74.3   | 2.456           | -59.7 | 0.106           | -46.1 | 0.396           | 91.6   |
| 18000.0000       | 0.581           | 67.3   | 2.297           | -65.8 | 0.103           | -48.0 | 0.400           | 87.1   |

**AMPLIFIER PARAMETERS**

V<sub>DS</sub> = 2 V, I<sub>D</sub> = 10 mA

| FREQUENCY<br>MHz | GU <sub>max</sub><br>dB | GA <sub>max</sub><br>dB | S <sub>21</sub>   <sup>2</sup><br>dB | S <sub>12</sub>   <sup>2</sup><br>dB | K    | Delay<br>ns | Mason's U<br>dB | G1<br>dB | G2<br>dB |
|------------------|-------------------------|-------------------------|--------------------------------------|--------------------------------------|------|-------------|-----------------|----------|----------|
| 2000.0000        | 27.67                   |                         | 12.94                                | -31.55                               | 0.25 | 0.038       | 30.256          | 12.61    | 2.12     |
| 2500.0000        | 25.31                   |                         | 12.94                                | -29.62                               | 0.32 | 0.038       | 28.341          | 10.35    | 2.02     |
| 3000.0000        | 23.75                   |                         | 12.95                                | -28.24                               | 0.38 | 0.040       | 26.068          | 8.92     | 1.87     |
| 3500.0000        | 22.25                   |                         | 12.84                                | -27.19                               | 0.44 | 0.039       | 25.369          | 7.64     | 1.77     |
| 4000.0000        | 21.07                   |                         | 12.68                                | -26.58                               | 0.51 | 0.037       | 23.501          | 6.73     | 1.66     |
| 4500.0000        | 20.15                   |                         | 12.56                                | -25.82                               | 0.57 | 0.035       | 22.666          | 6.00     | 1.59     |
| 5000.0000        | 19.29                   |                         | 12.39                                | -25.36                               | 0.63 | 0.033       | 21.854          | 5.36     | 1.54     |
| 5500.0000        | 18.67                   |                         | 12.32                                | -24.81                               | 0.68 | 0.032       | 21.290          | 4.87     | 1.48     |
| 6000.0000        | 18.21                   |                         | 12.30                                | -24.30                               | 0.71 | 0.032       | 21.403          | 4.47     | 1.44     |
| 6500.0000        | 17.75                   |                         | 12.36                                | -23.49                               | 0.72 | 0.034       | 21.682          | 4.03     | 1.37     |
| 7000.0000        | 16.97                   |                         | 12.41                                | -22.94                               | 0.80 | 0.037       | 20.537          | 3.33     | 1.22     |
| 7500.0000        | 16.21                   |                         | 12.42                                | -22.70                               | 0.90 | 0.038       | 19.541          | 2.75     | 1.04     |
| 8000.0000        | 15.69                   |                         | 12.43                                | -22.29                               | 0.94 | 0.037       | 19.390          | 2.40     | 0.85     |
| 8500.0000        | 15.28                   |                         | 12.49                                | -21.76                               | 0.96 | 0.040       | 19.809          | 2.10     | 0.70     |
| 9000.0000        | 14.85                   |                         | 12.44                                | -21.32                               | 0.98 | 0.042       | 19.658          | 1.87     | 0.55     |
| 9500.0000        | 14.39                   | 16.34                   | 12.32                                | -20.83                               | 1.00 | 0.040       | 19.512          | 1.65     | 0.41     |
| 10000.0000       | 14.01                   | 15.53                   | 12.19                                | -20.53                               | 1.02 | 0.039       | 19.822          | 1.49     | 0.33     |
| 10500.0000       | 13.72                   | 15.40                   | 12.09                                | -20.11                               | 1.01 | 0.040       | 20.318          | 1.35     | 0.28     |
| 11000.0000       | 13.39                   | 14.90                   | 11.96                                | -19.74                               | 1.02 | 0.039       | 20.322          | 1.18     | 0.25     |
| 11500.0000       | 13.09                   | 14.27                   | 11.83                                | -19.67                               | 1.06 | 0.039       | 19.926          | 1.03     | 0.22     |
| 12000.0000       | 12.81                   | 13.92                   | 11.71                                | -19.33                               | 1.07 | 0.042       | 20.054          | 0.90     | 0.21     |
| 12500.0000       | 12.54                   | 13.56                   | 11.52                                | -19.11                               | 1.08 | 0.042       | 20.125          | 0.86     | 0.17     |
| 13000.0000       | 12.28                   | 13.16                   | 11.31                                | -18.97                               | 1.11 | 0.042       | 19.648          | 0.85     | 0.12     |
| 13500.0000       | 12.02                   | 12.78                   | 11.01                                | -19.05                               | 1.14 | 0.042       | 19.328          | 0.92     | 0.09     |
| 14000.0000       | 11.80                   | 12.51                   | 10.68                                | -19.03                               | 1.15 | 0.041       | 19.111          | 1.04     | 0.08     |
| 14500.0000       | 11.66                   | 12.38                   | 10.33                                | -18.96                               | 1.14 | 0.039       | 19.447          | 1.22     | 0.11     |
| 15000.0000       | 11.58                   | 12.32                   | 9.97                                 | -19.10                               | 1.13 | 0.041       | 19.785          | 1.42     | 0.20     |
| 15500.0000       | 11.35                   | 12.01                   | 9.55                                 | -19.25                               | 1.16 | 0.036       | 19.151          | 1.51     | 0.29     |
| 16000.0000       | 11.22                   | 11.95                   | 9.20                                 | -19.33                               | 1.15 | 0.037       | 19.274          | 1.60     | 0.41     |
| 16500.0000       | 11.03                   | 11.80                   | 8.83                                 | -19.41                               | 1.15 | 0.041       | 18.894          | 1.64     | 0.56     |
| 17000.0000       | 10.67                   | 11.40                   | 8.33                                 | -19.37                               | 1.16 | 0.039       | 17.879          | 1.66     | 0.68     |
| 17500.0000       | 10.26                   | 10.86                   | 7.81                                 | -19.46                               | 1.21 | 0.035       | 16.470          | 1.72     | 0.74     |
| 18000.0000       | 9.77                    | 10.19                   | 7.22                                 | -19.74                               | 1.30 | 0.034       | 14.659          | 1.78     | 0.76     |

**S-PARAMETERS**  
**MAG. AND ANG.**

**V<sub>DS</sub> = 0 V, V<sub>GS</sub> = 0 V**

| FREQUENCY<br>MHz | S <sub>11</sub> |        | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |       |
|------------------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|-------|
|                  | MAG.            | ANG.   | MAG.            | ANG.  | MAG.            | ANG.  | MAG.            | ANG.  |
| 2000.0000        | 0.990           | -20.7  | 0.016           | 109.0 | 0.016           | 102.3 | 0.751           | 151.4 |
| 2500.0000        | 0.981           | -27.1  | 0.022           | 103.4 | 0.020           | 103.6 | 0.751           | 145.4 |
| 3000.0000        | 0.978           | -33.8  | 0.028           | 103.5 | 0.028           | 101.6 | 0.762           | 139.8 |
| 3500.0000        | 0.972           | -40.2  | 0.035           | 102.0 | 0.033           | 100.1 | 0.756           | 134.2 |
| 4000.0000        | 0.966           | -46.4  | 0.042           | 98.5  | 0.041           | 97.5  | 0.760           | 128.8 |
| 4500.0000        | 0.962           | -52.4  | 0.052           | 96.0  | 0.050           | 94.8  | 0.761           | 122.4 |
| 5000.0000        | 0.957           | -57.6  | 0.061           | 91.4  | 0.059           | 91.1  | 0.755           | 115.8 |
| 5500.0000        | 0.954           | -63.3  | 0.070           | 88.1  | 0.070           | 86.6  | 0.755           | 109.2 |
| 6000.0000        | 0.949           | -69.1  | 0.080           | 83.7  | 0.080           | 82.6  | 0.758           | 102.2 |
| 6500.0000        | 0.944           | -75.8  | 0.092           | 77.8  | 0.092           | 77.9  | 0.757           | 95.4  |
| 7000.0000        | 0.930           | -83.5  | 0.107           | 73.0  | 0.105           | 71.9  | 0.765           | 88.8  |
| 7500.0000        | 0.916           | -92.8  | 0.121           | 66.5  | 0.120           | 66.3  | 0.773           | 83.4  |
| 8000.0000        | 0.905           | -103.2 | 0.135           | 59.3  | 0.133           | 58.8  | 0.780           | 78.7  |
| 8500.0000        | 0.894           | -114.6 | 0.147           | 51.6  | 0.146           | 51.6  | 0.793           | 75.3  |
| 9000.0000        | 0.885           | -126.2 | 0.158           | 45.1  | 0.158           | 44.3  | 0.804           | 72.4  |
| 9500.0000        | 0.878           | -137.1 | 0.169           | 38.3  | 0.168           | 38.2  | 0.809           | 69.6  |
| 10000.0000       | 0.871           | -147.7 | 0.181           | 32.0  | 0.179           | 31.7  | 0.819           | 66.7  |
| 10500.0000       | 0.873           | -158.2 | 0.193           | 25.6  | 0.192           | 25.5  | 0.821           | 63.6  |
| 11000.0000       | 0.875           | -169.7 | 0.205           | 17.9  | 0.205           | 17.8  | 0.821           | 60.4  |
| 11500.0000       | 0.873           | 178.0  | 0.218           | 9.8   | 0.216           | 9.9   | 0.820           | 55.9  |
| 12000.0000       | 0.863           | 164.3  | 0.227           | 1.5   | 0.225           | 1.3   | 0.819           | 51.7  |
| 12500.0000       | 0.869           | 150.7  | 0.231           | -7.0  | 0.231           | -7.6  | 0.819           | 46.6  |
| 13000.0000       | 0.868           | 137.7  | 0.230           | -15.4 | 0.230           | -15.8 | 0.831           | 41.8  |
| 13500.0000       | 0.869           | 126.0  | 0.225           | -22.7 | 0.226           | -24.0 | 0.841           | 37.3  |
| 14000.0000       | 0.880           | 115.8  | 0.219           | -29.7 | 0.217           | -29.3 | 0.850           | 34.6  |
| 14500.0000       | 0.892           | 107.3  | 0.212           | -33.7 | 0.213           | -34.1 | 0.858           | 33.2  |
| 15000.0000       | 0.907           | 98.5   | 0.207           | -39.4 | 0.206           | -39.4 | 0.866           | 32.5  |
| 15500.0000       | 0.904           | 90.7   | 0.201           | -43.9 | 0.199           | -44.0 | 0.870           | 32.2  |
| 16000.0000       | 0.905           | 83.7   | 0.198           | -48.1 | 0.199           | -47.8 | 0.866           | 31.7  |
| 16500.0000       | 0.884           | 75.5   | 0.194           | -53.0 | 0.191           | -52.9 | 0.863           | 30.5  |
| 17000.0000       | 0.867           | 67.7   | 0.188           | -58.1 | 0.188           | -58.0 | 0.861           | 28.1  |
| 17500.0000       | 0.846           | 60.0   | 0.182           | -62.4 | 0.182           | -63.0 | 0.856           | 24.5  |
| 18000.0000       | 0.831           | 54.0   | 0.172           | -67.1 | 0.174           | -67.5 | 0.850           | 20.0  |

**AMPLIFIER PARAMETERS**

V<sub>DS</sub> = 0 V, V<sub>GS</sub> = 0 V

| FREQUENCY<br>MHz | GU <sub>max</sub><br>dB | GA <sub>max</sub><br>dB | S <sub>21</sub>   <sup>2</sup><br>dB | S <sub>12</sub>   <sup>2</sup><br>dB | K     | Delay<br>ns | Mason's U<br>dB | G1<br>dB | G2<br>dB |
|------------------|-------------------------|-------------------------|--------------------------------------|--------------------------------------|-------|-------------|-----------------|----------|----------|
| 2000.0000        | -15.19                  | -15.16                  | -36.00                               | -35.92                               | 16.25 | 0.031       | -33.488         | 17.21    | 3.60     |
| 2500.0000        | -15.56                  | -15.55                  | -33.32                               | -33.83                               | 19.06 | 0.031       | -40.201         | 14.15    | 3.61     |
| 3000.0000        | -13.78                  | -13.82                  | -31.18                               | -31.20                               | 12.08 | -0.001      | -42.783         | 13.62    | 3.78     |
| 3500.0000        | -12.82                  | -12.91                  | -29.06                               | -29.53                               | 10.34 | 0.009       | -36.658         | 12.55    | 3.69     |
| 4000.0000        | -12.01                  | -12.15                  | -27.46                               | -27.66                               | 8.42  | 0.019       | -42.595         | 11.71    | 3.74     |
| 4500.0000        | -10.64                  | -10.88                  | -25.71                               | -25.99                               | 6.36  | 0.014       | -38.655         | 11.32    | 3.75     |
| 5000.0000        | -9.97                   | -10.27                  | -24.36                               | -24.54                               | 5.48  | 0.025       | -42.970         | 10.72    | 3.67     |
| 5500.0000        | -8.93                   | -9.35                   | -23.06                               | -23.10                               | 4.38  | 0.018       | -39.542         | 10.47    | 3.66     |
| 6000.0000        | -8.16                   | -8.69                   | -21.90                               | -21.98                               | 3.80  | 0.025       | -40.847         | 10.03    | 3.71     |
| 6500.0000        | -7.40                   | -8.05                   | -20.76                               | -20.70                               | 3.25  | 0.033       | -49.494         | 9.66     | 3.70     |
| 7000.0000        | -6.88                   | -7.62                   | -19.40                               | -19.61                               | 3.05  | 0.027       | -36.513         | 8.69     | 3.82     |
| 7500.0000        | -6.50                   | -7.33                   | -18.38                               | -18.39                               | 2.80  | 0.036       | -53.452         | 7.93     | 3.94     |
| 8000.0000        | -5.91                   | -6.83                   | -17.42                               | -17.50                               | 2.54  | 0.040       | -42.015         | 7.44     | 4.06     |
| 8500.0000        | -5.40                   | -6.42                   | -16.66                               | -16.69                               | 2.31  | 0.043       | -52.459         | 6.96     | 4.30     |
| 9000.0000        | -4.90                   | -6.03                   | -16.05                               | -16.02                               | 2.12  | 0.036       | -40.046         | 6.63     | 4.52     |
| 9500.0000        | -4.45                   | -5.67                   | -15.46                               | -15.49                               | 1.99  | 0.038       | -51.895         | 6.39     | 4.62     |
| 10000.0000       | -3.86                   | -5.22                   | -14.85                               | -14.95                               | 1.83  | 0.035       | -40.055         | 6.17     | 4.82     |
| 10500.0000       | -3.21                   | -4.74                   | -14.30                               | -14.32                               | 1.66  | 0.035       | -48.996         | 6.23     | 4.86     |
| 11000.0000       | -2.61                   | -4.26                   | -13.78                               | -13.78                               | 1.52  | 0.043       | -60.695         | 6.29     | 4.88     |
| 11500.0000       | -2.16                   | -3.92                   | -13.24                               | -13.33                               | 1.45  | 0.045       | -39.289         | 6.23     | 4.86     |
| 12000.0000       | -2.13                   | -3.90                   | -12.89                               | -12.97                               | 1.44  | 0.046       | -39.470         | 5.93     | 4.83     |
| 12500.0000       | -1.81                   | -3.72                   | -12.74                               | -12.72                               | 1.39  | 0.047       | -38.276         | 6.10     | 4.83     |
| 13000.0000       | -1.59                   | -3.62                   | -12.77                               | -12.76                               | 1.37  | 0.047       | -42.090         | 6.07     | 5.11     |
| 13500.0000       | -1.50                   | -3.60                   | -12.94                               | -12.93                               | 1.36  | 0.040       | -31.392         | 6.11     | 5.34     |
| 14000.0000       | -1.16                   | -3.42                   | -13.19                               | -13.28                               | 1.33  | 0.039       | -36.132         | 6.47     | 5.56     |
| 14500.0000       | -0.79                   | -3.27                   | -13.48                               | -13.45                               | 1.29  | 0.022       | -40.171         | 6.90     | 5.80     |
| 15000.0000       | -0.19                   | -2.83                   | -13.68                               | -13.74                               | 1.23  | 0.032       | -40.013         | 7.51     | 6.01     |
| 15500.0000       | -0.41                   | -2.97                   | -13.93                               | -14.02                               | 1.25  | 0.025       | -36.170         | 7.37     | 6.15     |
| 16000.0000       | -0.62                   | -3.10                   | -14.06                               | -14.03                               | 1.26  | 0.024       | -40.930         | 7.42     | 6.03     |
| 16500.0000       | -1.71                   | -3.79                   | -14.26                               | -14.37                               | 1.42  | 0.027       | -37.301         | 6.62     | 5.94     |
| 17000.0000       | -2.63                   | -4.43                   | -14.53                               | -14.54                               | 1.57  | 0.028       | -55.485         | 6.04     | 5.86     |
| 17500.0000       | -3.61                   | -5.16                   | -14.82                               | -14.78                               | 1.79  | 0.024       | -40.919         | 5.47     | 5.74     |
| 18000.0000       | -4.60                   | -5.92                   | -15.27                               | -15.19                               | 2.07  | 0.026       | -42.429         | 5.10     | 5.57     |



**S-PARAMETERS**  
**MAG. AND ANG.**

$V_{DS} = 0\text{ V}$ ,  $V_{GS} = -2.5\text{ V}$

| FREQUENCY<br>MHz | S <sub>11</sub> |        | S <sub>21</sub> |        | S <sub>12</sub> |        | S <sub>22</sub> |        |
|------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|
|                  | MAG.            | ANG.   | MAG.            | ANG.   | MAG.            | ANG.   | MAG.            | ANG.   |
| 2000.0000        | 0.994           | -12.8  | 0.040           | 74.2   | 0.041           | 74.9   | 0.982           | -15.4  |
| 2500.0000        | 0.985           | -16.9  | 0.051           | 69.4   | 0.050           | 68.3   | 0.981           | -20.0  |
| 3000.0000        | 0.982           | -21.3  | 0.061           | 65.3   | 0.061           | 64.1   | 0.976           | -24.8  |
| 3500.0000        | 0.976           | -25.4  | 0.070           | 59.3   | 0.070           | 59.2   | 0.973           | -29.7  |
| 4000.0000        | 0.972           | -29.2  | 0.079           | 54.6   | 0.079           | 54.1   | 0.966           | -34.6  |
| 4500.0000        | 0.970           | -33.0  | 0.087           | 50.3   | 0.087           | 49.3   | 0.965           | -39.3  |
| 5000.0000        | 0.968           | -36.0  | 0.095           | 45.4   | 0.094           | 45.1   | 0.962           | -43.5  |
| 5500.0000        | 0.963           | -38.8  | 0.101           | 41.6   | 0.102           | 41.3   | 0.961           | -47.5  |
| 6000.0000        | 0.964           | -41.7  | 0.109           | 39.3   | 0.110           | 38.9   | 0.957           | -50.7  |
| 6500.0000        | 0.960           | -44.3  | 0.121           | 36.6   | 0.119           | 35.6   | 0.956           | -54.8  |
| 7000.0000        | 0.952           | -47.2  | 0.135           | 31.2   | 0.134           | 31.9   | 0.957           | -58.9  |
| 7500.0000        | 0.947           | -50.8  | 0.148           | 26.5   | 0.148           | 26.4   | 0.949           | -63.1  |
| 8000.0000        | 0.941           | -55.4  | 0.161           | 22.0   | 0.161           | 21.5   | 0.939           | -67.5  |
| 8500.0000        | 0.936           | -61.1  | 0.176           | 16.5   | 0.176           | 16.7   | 0.932           | -73.0  |
| 9000.0000        | 0.930           | -67.1  | 0.193           | 10.4   | 0.194           | 10.0   | 0.923           | -79.2  |
| 9500.0000        | 0.922           | -73.3  | 0.208           | 4.1    | 0.209           | 3.6    | 0.913           | -86.8  |
| 10000.0000       | 0.912           | -78.7  | 0.221           | -2.8   | 0.223           | -2.8   | 0.903           | -94.9  |
| 10500.0000       | 0.908           | -84.2  | 0.236           | -8.8   | 0.238           | -9.3   | 0.900           | -103.4 |
| 11000.0000       | 0.908           | -89.3  | 0.253           | -15.8  | 0.254           | -16.1  | 0.900           | -111.7 |
| 11500.0000       | 0.905           | -94.9  | 0.267           | -22.0  | 0.268           | -23.0  | 0.899           | -118.7 |
| 12000.0000       | 0.898           | -101.4 | 0.284           | -30.3  | 0.283           | -30.7  | 0.906           | -126.7 |
| 12500.0000       | 0.901           | -108.7 | 0.300           | -38.0  | 0.300           | -38.8  | 0.899           | -134.6 |
| 13000.0000       | 0.893           | -117.4 | 0.316           | -47.4  | 0.317           | -47.8  | 0.894           | -143.1 |
| 13500.0000       | 0.876           | -127.1 | 0.328           | -57.2  | 0.328           | -57.8  | 0.880           | -153.0 |
| 14000.0000       | 0.866           | -138.2 | 0.334           | -68.3  | 0.334           | -68.9  | 0.877           | -164.1 |
| 14500.0000       | 0.860           | -149.8 | 0.332           | -80.4  | 0.331           | -80.9  | 0.875           | -177.7 |
| 15000.0000       | 0.865           | -161.4 | 0.320           | -93.4  | 0.322           | -93.4  | 0.877           | 168.2  |
| 15500.0000       | 0.866           | -172.6 | 0.298           | -104.7 | 0.298           | -105.5 | 0.880           | 155.6  |
| 16000.0000       | 0.883           | 177.5  | 0.273           | -115.0 | 0.272           | -115.5 | 0.893           | 144.2  |
| 16500.0000       | 0.888           | 166.8  | 0.249           | -125.2 | 0.248           | -125.3 | 0.913           | 135.1  |
| 17000.0000       | 0.874           | 153.9  | 0.226           | -135.9 | 0.223           | -136.1 | 0.924           | 127.5  |
| 17500.0000       | 0.865           | 140.6  | 0.203           | -147.2 | 0.199           | -147.2 | 0.932           | 120.9  |
| 18000.0000       | 0.839           | 126.8  | 0.170           | -156.8 | 0.171           | -159.4 | 0.927           | 114.0  |

**AMPLIFIER PARAMETERS**

**V<sub>DS</sub> = 0 V, V<sub>GS</sub> = -2.5 V**

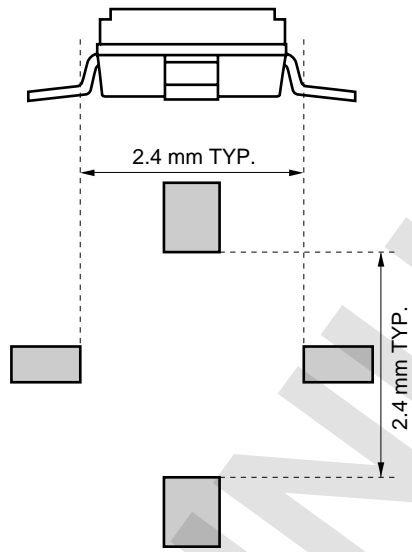
| FREQUENCY<br>MHz | GU <sub>max</sub><br>dB | GA <sub>max</sub><br>dB | S <sub>21</sub>   <sup>2</sup><br>dB | S <sub>12</sub>   <sup>2</sup><br>dB | K    | Delay<br>ns | Mason's U<br>dB | G1<br>dB | G2<br>dB |
|------------------|-------------------------|-------------------------|--------------------------------------|--------------------------------------|------|-------------|-----------------|----------|----------|
| 2000.0000        | 5.45                    | -2.13                   | -27.93                               | -27.82                               | 1.12 | 0.026       | -28.423         | 18.97    | 14.41    |
| 2500.0000        | 3.65                    | -2.54                   | -25.89                               | -25.96                               | 1.18 | 0.026       | -29.391         | 15.27    | 14.27    |
| 3000.0000        | 3.32                    | -2.67                   | -24.34                               | -24.23                               | 1.19 | 0.023       | -27.770         | 14.51    | 13.16    |
| 3500.0000        | 2.83                    | -2.75                   | -23.07                               | -23.05                               | 1.21 | 0.033       | -49.384         | 13.23    | 12.67    |
| 4000.0000        | 2.30                    | -2.91                   | -22.10                               | -22.00                               | 1.23 | 0.026       | -33.498         | 12.62    | 11.78    |
| 4500.0000        | 2.73                    | -2.68                   | -21.18                               | -21.19                               | 1.20 | 0.024       | -30.661         | 12.24    | 11.67    |
| 5000.0000        | 2.73                    | -2.61                   | -20.47                               | -20.50                               | 1.19 | 0.027       | -39.320         | 11.96    | 11.25    |
| 5500.0000        | 2.68                    | -2.61                   | -19.91                               | -19.86                               | 1.18 | 0.021       | -37.388         | 11.44    | 11.15    |
| 6000.0000        | 2.93                    | -2.52                   | -19.26                               | -19.20                               | 1.17 | 0.013       | -34.861         | 11.45    | 10.75    |
| 6500.0000        | 3.36                    | -2.26                   | -18.34                               | -18.49                               | 1.15 | 0.015       | -26.993         | 11.02    | 10.68    |
| 7000.0000        | 3.59                    | -2.11                   | -17.41                               | -17.46                               | 1.12 | 0.030       | -31.857         | 10.29    | 10.72    |
| 7500.0000        | 3.29                    | -2.11                   | -16.61                               | -16.62                               | 1.12 | 0.026       | -45.807         | 9.86     | 10.05    |
| 8000.0000        | 2.84                    | -2.21                   | -15.87                               | -15.87                               | 1.13 | 0.025       | -35.681         | 9.43     | 9.28     |
| 8500.0000        | 2.78                    | -2.18                   | -15.09                               | -15.10                               | 1.13 | 0.031       | -40.714         | 9.05     | 8.82     |
| 9000.0000        | 2.69                    | -2.14                   | -14.31                               | -14.26                               | 1.12 | 0.034       | -35.203         | 8.72     | 8.28     |
| 9500.0000        | 2.37                    | -2.23                   | -13.63                               | -13.60                               | 1.13 | 0.035       | -35.298         | 8.24     | 7.77     |
| 10000.0000       | 2.00                    | -2.34                   | -13.10                               | -13.03                               | 1.14 | 0.038       | -37.411         | 7.75     | 7.35     |
| 10500.0000       | 2.23                    | -2.22                   | -12.55                               | -12.47                               | 1.13 | 0.034       | -31.948         | 7.58     | 7.20     |
| 11000.0000       | 2.80                    | -1.90                   | -11.94                               | -11.89                               | 1.09 | 0.039       | -36.170         | 7.54     | 7.20     |
| 11500.0000       | 3.15                    | -1.69                   | -11.47                               | -11.44                               | 1.08 | 0.034       | -27.602         | 7.44     | 7.17     |
| 12000.0000       | 3.69                    | -1.33                   | -10.94                               | -10.97                               | 1.05 | 0.046       | -30.925         | 7.14     | 7.48     |
| 12500.0000       | 3.99                    | -1.10                   | -10.46                               | -10.45                               | 1.03 | 0.043       | -25.841         | 7.27     | 7.19     |
| 13000.0000       | 3.91                    | -0.98                   | -9.99                                | -9.98                                | 1.03 | 0.052       | -30.075         | 6.95     | 6.96     |
| 13500.0000       | 3.12                    | -1.26                   | -9.68                                | -9.68                                | 1.04 | 0.055       | -29.034         | 6.33     | 6.47     |
| 14000.0000       | 2.86                    | -1.36                   | -9.53                                | -9.51                                | 1.05 | 0.061       | -29.463         | 6.01     | 6.38     |
| 14500.0000       | 2.55                    | -1.54                   | -9.58                                | -9.60                                | 1.06 | 0.067       | -31.274         | 5.84     | 6.29     |
| 15000.0000       | 2.47                    | -1.64                   | -9.90                                | -9.85                                | 1.07 | 0.073       | -37.889         | 5.99     | 6.38     |
| 15500.0000       | 1.95                    | -1.97                   | -10.52                               | -10.52                               | 1.10 | 0.062       | -29.488         | 6.01     | 6.47     |
| 16000.0000       | 2.23                    | -1.99                   | -11.28                               | -11.31                               | 1.11 | 0.057       | -34.340         | 6.57     | 6.93     |
| 16500.0000       | 2.46                    | -1.97                   | -12.07                               | -12.11                               | 1.11 | 0.057       | -38.158         | 6.76     | 7.78     |
| 17000.0000       | 1.68                    | -2.33                   | -12.92                               | -13.03                               | 1.15 | 0.059       | -32.987         | 6.27     | 8.34     |
| 17500.0000       | 0.92                    | -2.67                   | -13.87                               | -14.04                               | 1.21 | 0.063       | -30.080         | 6.00     | 8.79     |
| 18000.0000       | -1.59                   | -4.11                   | -15.41                               | -15.35                               | 1.47 | 0.054       | -26.585         | 5.28     | 8.53     |

## NOISE PARAMETERS

 $V_{DS} = 2\text{ V}$ ,  $I_D = 10\text{ mA}$ 

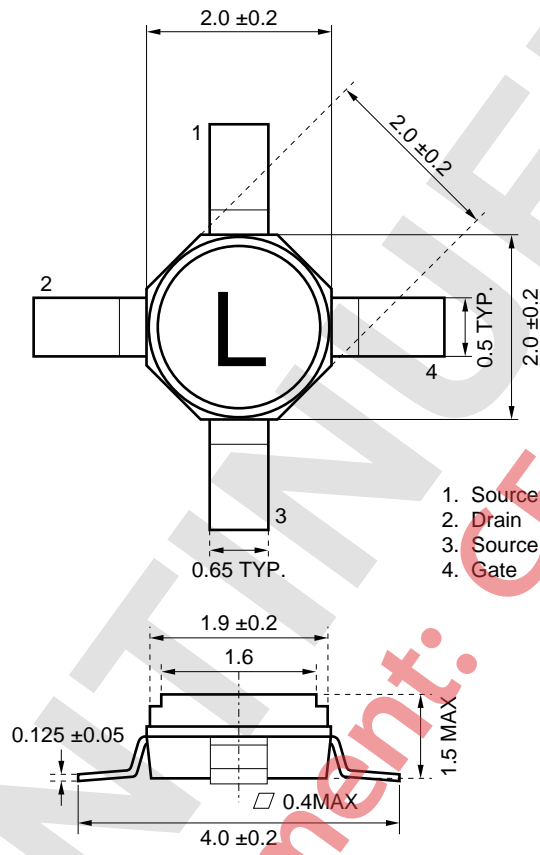
| Freq. (GHz) | NF <sub>min.</sub> (dB) | G <sub>a</sub> (dB) | Γ <sub>opt</sub> |      | Rn/50 |
|-------------|-------------------------|---------------------|------------------|------|-------|
|             |                         |                     | MAG.             | ANG. |       |
| 2.0         | 0.29                    | 20.7                | 0.94             | 12   | 0.38  |
| 4.0         | 0.30                    | 18.7                | 0.80             | 26   | 0.33  |
| 6.0         | 0.33                    | 17.0                | 0.66             | 44   | 0.26  |
| 8.0         | 0.38                    | 15.4                | 0.50             | 68   | 0.18  |
| 10.0        | 0.43                    | 14.1                | 0.38             | 97   | 0.11  |
| 12.0        | 0.50                    | 13.0                | 0.29             | 133  | 0.09  |
| 14.0        | 0.59                    | 12.3                | 0.27             | 177  | 0.08  |
| 16.0        | 0.71                    | 11.8                | 0.33             | -129 | 0.11  |
| 18.0        | 0.86                    | 11.2                | 0.39             | -82  | 0.23  |

TYPICAL MOUNT PAD LAYOUT



DISCONTINUED  
Drop-In Replacement: CE3512K2

PACKAGE DIMENSIONS (Unit: mm)



DISCOMMANAGED  
Drop-In Replacement: CE3572K2

**NOTE ON CORRECT USE**

- (1) Because this device is a GaAs MES FET with a Schottky barrier gate structure, it is necessary that sufficient care be taken regarding static electricity and strong electric fields.  
Take measures against static electricity and make sure the body is earthed when mounting the device.
- (2) Follow the procedure below when operating the device by a gate-and-drain-independent dual power supply.  
Directly ground both the source pins.  
 $V_{GS}$  = fixed to approximately  $-4$  V.  
Increase  $V_{DS}$  to a predetermined voltage level (within the recommended operating range of  $V_{DS}$ ).  
Adjust  $V_{GS}$  in line with a predetermined  $I_D$ .
- (3) It is recommended that the bias application circuit be able to have a fixed voltage and current.
- (4) Adjust the I/O matching circuit after turning the bias OFF.

**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered under the following recommended conditions

| Soldering Method | Soldering Conditions   | Recommended Condition Symbol |
|------------------|--|------------------------------|
| Infrared Reflow  | Package peak temperature: 230 °C or below<br>Time: 30 seconds or less (at 210 °C)<br>Count: 1, Exposure limit : None <sup>Note</sup> | IR30-00-1                    |
| Partial Heating  | Pin temperature: 230 °C<br>Time: 10 seconds or less (per pin row)<br>Exposure limit : None <sup>Note</sup>                           | —                            |

**Note** After opening the dry pack, keep it in a place below 25 °C and 65 % RH for the allowable storage period.

**Caution** Do not use different soldering methods together (except for partial heating).

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