



# DATA SHEET

## HETERO JUNCTION FIELD EFFECT TRANSISTOR NE3210S01

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

#### DESCRIPTION

The NE3210S01 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 = 0.35 dB TYP. Ga = 13.5 dB TYP. at 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   | Supplying Form              | Marking |
|---------------|-----------------------------|---------|
| NE3210S01-T1  | Tape & reel 1 000 pcs./reel | K       |
| NE3210S01-T1B | Tape & reel 4 000 pcs./reel |         |

**Remark** For sample order, please contact your nearby sales office. (Part number for sample order: NE3210S01-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           | $I_D$     | IDSS        | 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 ( $T_A = +25^\circ\text{C}$ )

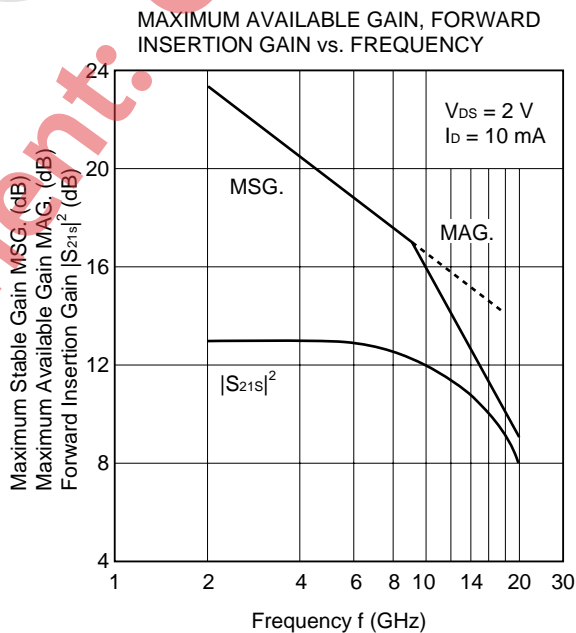
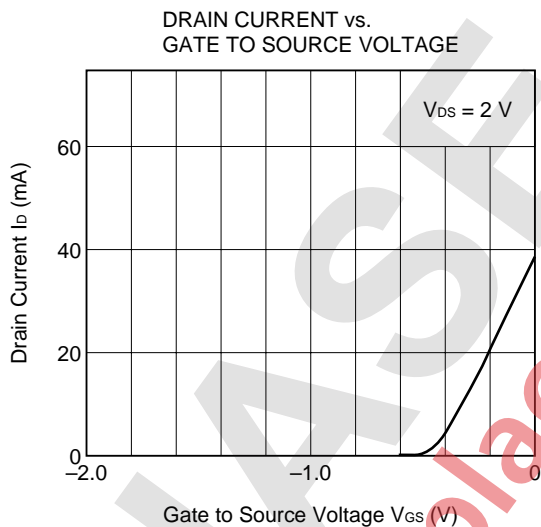
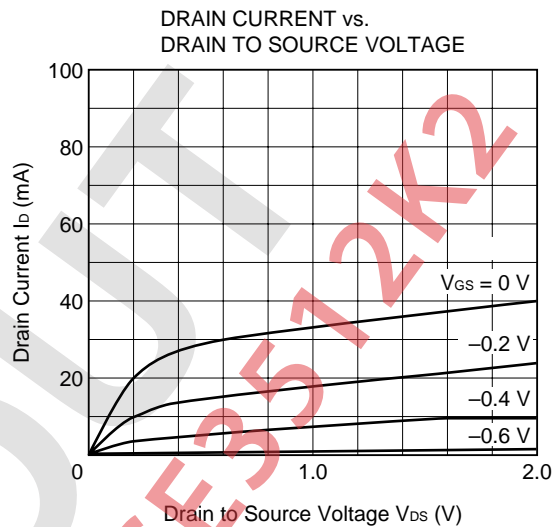
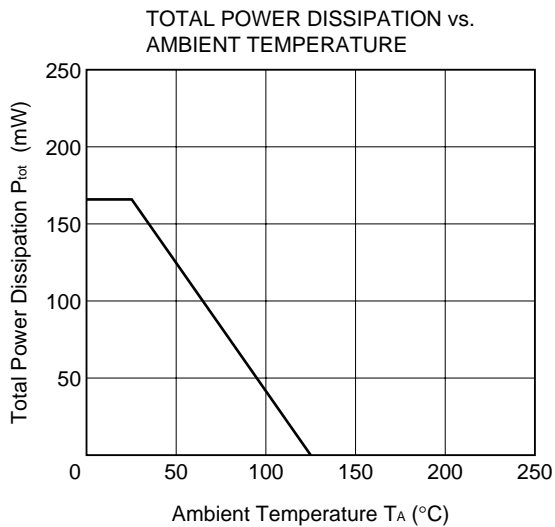
| Characteristics           | Symbol   | MIN. | TYP. | MAX. | Unit |
|---------------------------|----------|------|------|------|------|
| ★ Drain to Source Voltage | $V_{DS}$ | 1    | 2    | 3    | V    |
| ★ Drain Current           | $I_D$    | 5    | 10   | 15   | mA   |
| Input Power           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

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

| Characteristics                | 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  | -    | 0.35 | 0.45 | dB   |
| Associated Gain                | G <sub>a</sub>       | f = 12 GHz                                      | 12.0 | 13.5 | -    | dB   |

PHASE-OUT  
 Drop-In Replacement: CE3512V

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

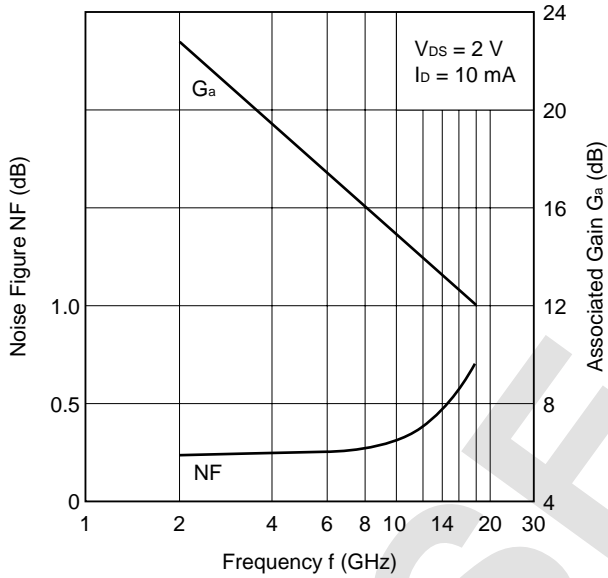


Gain Calculations

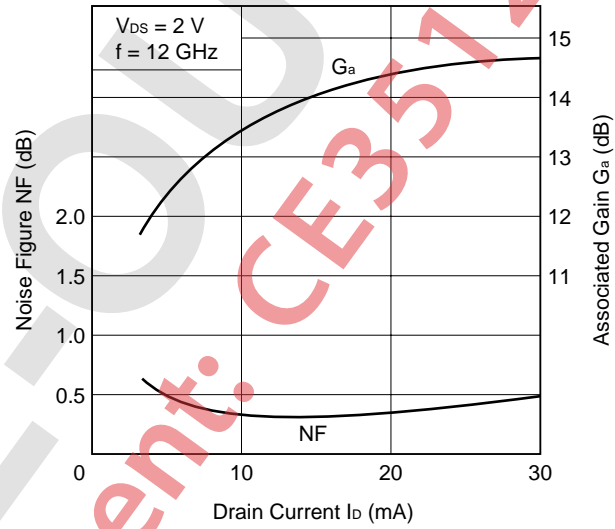
$$MSG. = \left| \frac{S_{21}}{S_{12}} \right| \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}$$

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

NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



NOISE FIGURE, ASSOCIATED GAIN vs. DRAIN CURRENT



PHASER  
 Drop-In Replacement: CE3512K2

**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        | 0.973           | -21.2  | 4.450           | 154.2 | 0.022           | 75.9  | 0.550           | -15.2  |
| 2500.0000        | 0.951           | -27.7  | 4.453           | 147.1 | 0.028           | 71.2  | 0.538           | -19.9  |
| 3000.0000        | 0.935           | -34.3  | 4.439           | 140.3 | 0.033           | 66.7  | 0.523           | -25.2  |
| 3500.0000        | 0.914           | -40.6  | 4.389           | 133.5 | 0.038           | 63.5  | 0.511           | -30.3  |
| 4000.0000        | 0.893           | -46.3  | 4.314           | 127.3 | 0.042           | 57.7  | 0.500           | -34.9  |
| 4500.0000        | 0.872           | -51.4  | 4.230           | 121.1 | 0.045           | 54.5  | 0.495           | -39.1  |
| 5000.0000        | 0.848           | -55.9  | 4.158           | 115.3 | 0.048           | 49.7  | 0.492           | -42.9  |
| 5500.0000        | 0.829           | -60.0  | 4.118           | 109.9 | 0.050           | 48.2  | 0.484           | -45.8  |
| 6000.0000        | 0.814           | -64.8  | 4.130           | 104.3 | 0.053           | 46.1  | 0.482           | -48.8  |
| 6500.0000        | 0.781           | -70.1  | 4.149           | 98.3  | 0.058           | 42.8  | 0.472           | -52.6  |
| 7000.0000        | 0.745           | -76.3  | 4.180           | 91.8  | 0.063           | 40.4  | 0.450           | -56.3  |
| 7500.0000        | 0.699           | -82.7  | 4.170           | 85.3  | 0.065           | 36.6  | 0.423           | -59.2  |
| 8000.0000        | 0.660           | -90.3  | 4.184           | 78.7  | 0.070           | 33.7  | 0.393           | -62.6  |
| 8500.0000        | 0.635           | -99.8  | 4.197           | 71.7  | 0.074           | 29.4  | 0.360           | -67.3  |
| 9000.0000        | 0.602           | -109.5 | 4.171           | 64.7  | 0.077           | 25.4  | 0.327           | -72.4  |
| 9500.0000        | 0.578           | -118.3 | 4.109           | 57.9  | 0.081           | 22.3  | 0.290           | -78.8  |
| 10000.0000       | 0.554           | -127.2 | 4.063           | 51.3  | 0.086           | 18.9  | 0.268           | -86.8  |
| 10500.0000       | 0.537           | -135.2 | 4.030           | 44.6  | 0.092           | 15.3  | 0.251           | -96.2  |
| 11000.0000       | 0.507           | -144.1 | 3.978           | 37.6  | 0.095           | 10.8  | 0.233           | -105.3 |
| 11500.0000       | 0.477           | -154.0 | 3.950           | 30.8  | 0.099           | 5.9   | 0.224           | -114.3 |
| 12000.0000       | 0.445           | -166.2 | 3.906           | 23.5  | 0.103           | 2.1   | 0.211           | -123.1 |
| 12500.0000       | 0.428           | -179.6 | 3.851           | 16.0  | 0.108           | -2.2  | 0.187           | -132.5 |
| 13000.0000       | 0.418           | 165.3  | 3.762           | 8.5   | 0.110           | -6.6  | 0.157           | -146.2 |
| 13500.0000       | 0.430           | 150.6  | 3.642           | 1.1   | 0.111           | -10.3 | 0.123           | -164.0 |
| 14000.0000       | 0.453           | 137.9  | 3.517           | -6.1  | 0.110           | -14.8 | 0.110           | 169.0  |
| 14500.0000       | 0.486           | 126.7  | 3.395           | -13.0 | 0.112           | -19.6 | 0.125           | 141.4  |
| 15000.0000       | 0.513           | 116.7  | 3.259           | -19.9 | 0.111           | -22.0 | 0.161           | 121.7  |
| 15500.0000       | 0.526           | 108.4  | 3.150           | -26.4 | 0.113           | -25.6 | 0.207           | 113.4  |
| 16000.0000       | 0.531           | 100.4  | 3.046           | -33.3 | 0.110           | -29.3 | 0.255           | 109.0  |
| 16500.0000       | 0.539           | 91.1   | 2.911           | -40.7 | 0.112           | -32.1 | 0.299           | 105.4  |
| 17000.0000       | 0.533           | 82.1   | 2.739           | -48.0 | 0.111           | -36.1 | 0.329           | 101.5  |
| 17500.0000       | 0.537           | 72.2   | 2.573           | -54.3 | 0.110           | -40.1 | 0.343           | 95.9   |
| 18000.0000       | 0.546           | 64.7   | 2.400           | -59.4 | 0.106           | -41.6 | 0.347           | 90.6   |

**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>nsec | Mason's U<br>dB | G1<br>dB | G2<br>dB |
|------------------|-------------------------|-------------------------|--------------------------------------|--------------------------------------|------|---------------|-----------------|----------|----------|
| 2000.0000        | 27.26                   |                         | 12.97                                | -33.03                               | 0.27 | 0.389         | 31.735          | 12.72    | 1.56     |
| 2500.0000        | 24.63                   |                         | 12.97                                | -31.20                               | 0.38 | 0.040         | 27.870          | 10.18    | 1.48     |
| 3000.0000        | 23.33                   |                         | 12.95                                | -29.75                               | 0.42 | 0.038         | 26.985          | 9.00     | 1.39     |
| 3500.0000        | 21.99                   |                         | 12.85                                | -28.44                               | 0.47 | 0.038         | 26.594          | 7.83     | 1.32     |
| 4000.0000        | 20.87                   |                         | 12.70                                | -27.53                               | 0.54 | 0.035         | 24.253          | 6.92     | 1.25     |
| 4500.0000        | 19.95                   |                         | 12.53                                | -26.98                               | 0.60 | 0.034         | 23.581          | 6.21     | 1.22     |
| 5000.0000        | 19.11                   |                         | 12.38                                | -26.29                               | 0.67 | 0.032         | 22.154          | 5.53     | 1.21     |
| 5500.0000        | 18.50                   |                         | 12.29                                | -26.00                               | 0.73 | 0.030         | 22.043          | 5.05     | 1.16     |
| 6000.0000        | 18.19                   |                         | 12.32                                | -25.48                               | 0.74 | 0.031         | 22.571          | 4.73     | 1.15     |
| 6500.0000        | 17.54                   |                         | 12.36                                | -24.70                               | 0.79 | 0.034         | 21.992          | 4.09     | 1.09     |
| 7000.0000        | 16.92                   |                         | 12.42                                | -24.08                               | 0.84 | 0.036         | 21.786          | 3.51     | 0.98     |
| 7500.0000        | 16.18                   |                         | 12.40                                | -23.76                               | 0.94 | 0.036         | 20.486          | 2.92     | 0.86     |
| 8000.0000        | 15.65                   |                         | 12.43                                | -23.13                               | 0.98 | 0.037         | 20.250          | 2.49     | 0.73     |
| 8500.0000        | 15.30                   |                         | 12.46                                | -22.59                               | 1.00 | 0.039         | 20.283          | 2.24     | 0.60     |
| 9000.0000        | 14.85                   | 16.16                   | 12.40                                | -22.22                               | 1.04 | 0.039         | 20.009          | 1.96     | 0.49     |
| 9500.0000        | 14.42                   | 15.56                   | 12.27                                | -21.80                               | 1.06 | 0.038         | 19.986          | 1.77     | 0.38     |
| 10000.0000       | 14.09                   | 15.25                   | 12.18                                | -21.32                               | 1.06 | 0.037         | 20.235          | 1.59     | 0.32     |
| 10500.0000       | 13.87                   | 15.24                   | 12.11                                | -20.75                               | 1.04 | 0.037         | 21.050          | 1.48     | 0.28     |
| 11000.0000       | 13.52                   | 14.66                   | 11.99                                | -20.46                               | 1.07 | 0.039         | 20.646          | 1.29     | 0.24     |
| 11500.0000       | 13.28                   | 14.39                   | 11.93                                | -20.07                               | 1.07 | 0.038         | 20.667          | 1.12     | 0.22     |
| 12000.0000       | 12.99                   | 13.98                   | 11.83                                | -19.76                               | 1.09 | 0.041         | 20.584          | 0.96     | 0.20     |
| 12500.0000       | 12.74                   | 13.69                   | 11.71                                | -19.35                               | 1.09 | 0.042         | 20.774          | 0.88     | 0.15     |
| 13000.0000       | 12.45                   | 13.26                   | 11.51                                | -19.17                               | 1.12 | 0.042         | 20.290          | 0.83     | 0.11     |
| 13500.0000       | 12.18                   | 12.87                   | 11.23                                | -19.12                               | 1.14 | 0.041         | 19.748          | 0.89     | 0.07     |
| 14000.0000       | 11.97                   | 12.58                   | 10.92                                | -19.15                               | 1.16 | 0.040         | 19.301          | 1.00     | 0.05     |
| 14500.0000       | 11.86                   | 12.48                   | 10.62                                | -19.02                               | 1.15 | 0.038         | 19.613          | 1.17     | 0.07     |
| 15000.0000       | 11.70                   | 12.27                   | 10.26                                | -19.06                               | 1.16 | 0.039         | 19.428          | 1.33     | 0.11     |
| 15500.0000       | 11.56                   | 12.16                   | 9.97                                 | -18.90                               | 1.14 | 0.036         | 19.651          | 1.41     | 0.19     |
| 16000.0000       | 11.41                   | 11.97                   | 9.67                                 | -19.17                               | 1.16 | 0.038         | 18.875          | 1.44     | 0.29     |
| 16500.0000       | 11.18                   | 11.75                   | 9.28                                 | -19.03                               | 1.16 | 0.041         | 18.560          | 1.49     | 0.41     |
| 17000.0000       | 10.70                   | 11.16                   | 8.75                                 | -19.11                               | 1.21 | 0.041         | 16.897          | 1.45     | 0.50     |
| 17500.0000       | 10.23                   | 10.54                   | 8.21                                 | -19.15                               | 1.27 | 0.035         | 15.483          | 1.48     | 0.54     |
| 18000.0000       | 9.70                    | 9.85                    | 7.60                                 | -19.53                               | 1.39 | 0.028         | 13.782          | 1.54     | 0.56     |

**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        | 0.987           | -21.3  | 0.013           | 103.3 | 0.015           | 109.1 | 0.775           | 151.9 |
| 2500.0000        | 0.984           | -27.9  | 0.019           | 103.6 | 0.020           | 102.3 | 0.786           | 145.8 |
| 3000.0000        | 0.978           | -34.8  | 0.024           | 106.2 | 0.026           | 106.6 | 0.786           | 140.4 |
| 3500.0000        | 0.973           | -41.5  | 0.031           | 102.7 | 0.033           | 105.2 | 0.787           | 134.6 |
| 4000.0000        | 0.967           | -47.7  | 0.039           | 99.2  | 0.039           | 101.9 | 0.786           | 129.0 |
| 4500.0000        | 0.964           | -53.6  | 0.048           | 97.3  | 0.048           | 99.3  | 0.783           | 123.0 |
| 5000.0000        | 0.959           | -59.1  | 0.056           | 95.2  | 0.057           | 94.9  | 0.782           | 116.4 |
| 5500.0000        | 0.954           | -64.8  | 0.067           | 90.9  | 0.068           | 90.9  | 0.781           | 109.7 |
| 6000.0000        | 0.948           | -70.7  | 0.077           | 85.9  | 0.079           | 86.8  | 0.782           | 103.2 |
| 6500.0000        | 0.944           | -77.9  | 0.087           | 81.4  | 0.090           | 81.4  | 0.781           | 96.6  |
| 7000.0000        | 0.934           | -85.5  | 0.102           | 76.1  | 0.104           | 76.8  | 0.785           | 90.2  |
| 7500.0000        | 0.920           | -95.5  | 0.117           | 70.0  | 0.118           | 70.2  | 0.796           | 84.7  |
| 8000.0000        | 0.906           | -106.1 | 0.132           | 62.7  | 0.132           | 62.9  | 0.802           | 80.4  |
| 8500.0000        | 0.893           | -117.9 | 0.144           | 55.8  | 0.144           | 55.2  | 0.814           | 76.7  |
| 9000.0000        | 0.885           | -129.6 | 0.155           | 48.4  | 0.158           | 48.7  | 0.819           | 73.8  |
| 9500.0000        | 0.877           | -140.4 | 0.167           | 41.9  | 0.166           | 42.2  | 0.830           | 70.7  |
| 10000.0000       | 0.873           | -151.4 | 0.177           | 35.7  | 0.179           | 35.9  | 0.832           | 67.9  |
| 10500.0000       | 0.876           | -162.1 | 0.190           | 28.8  | 0.193           | 29.2  | 0.836           | 64.3  |
| 11000.0000       | 0.874           | -173.2 | 0.205           | 21.9  | 0.206           | 21.4  | 0.838           | 60.7  |
| 11500.0000       | 0.874           | 174.1  | 0.219           | 13.9  | 0.218           | 13.5  | 0.837           | 56.5  |
| 12000.0000       | 0.867           | 160.1  | 0.228           | 5.1   | 0.229           | 5.2   | 0.839           | 52.1  |
| 12500.0000       | 0.870           | 146.2  | 0.232           | -4.0  | 0.232           | -3.5  | 0.838           | 47.3  |
| 13000.0000       | 0.872           | 132.8  | 0.230           | -11.4 | 0.232           | -11.6 | 0.845           | 42.8  |
| 13500.0000       | 0.874           | 121.0  | 0.227           | -19.4 | 0.227           | -19.7 | 0.854           | 38.5  |
| 14000.0000       | 0.884           | 110.6  | 0.218           | -26.4 | 0.221           | -25.5 | 0.862           | 35.9  |
| 14500.0000       | 0.899           | 101.9  | 0.211           | -30.5 | 0.215           | -30.6 | 0.871           | 34.0  |
| 15000.0000       | 0.904           | 92.9   | 0.208           | -35.0 | 0.208           | -35.4 | 0.879           | 33.5  |
| 15500.0000       | 0.907           | 85.1   | 0.201           | -39.5 | 0.201           | -40.0 | 0.882           | 33.0  |
| 16000.0000       | 0.907           | 77.7   | 0.198           | -43.9 | 0.200           | -44.0 | 0.876           | 32.4  |
| 16500.0000       | 0.900           | 69.3   | 0.198           | -49.3 | 0.198           | -49.5 | 0.877           | 30.8  |
| 17000.0000       | 0.881           | 60.5   | 0.192           | -54.4 | 0.194           | -54.5 | 0.878           | 28.5  |
| 17500.0000       | 0.860           | 52.8   | 0.183           | -59.2 | 0.186           | -60.2 | 0.875           | 25.4  |
| 18000.0000       | 0.846           | 46.0   | 0.176           | -63.5 | 0.176           | -63.9 | 0.866           | 21.4  |

**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>nsec | Mason's U<br>dB | G1<br>dB | G2<br>dB |
|------------------|-------------------------|-------------------------|--------------------------------------|--------------------------------------|-------|---------------|-----------------|----------|----------|
| 2000.0000        | -18.01                  | -18.00                  | -37.95                               | -36.77                               | 27.53 | -0.027        | -32.707         | 15.95    | 3.98     |
| 2500.0000        | -15.58                  | -15.57                  | -34.65                               | -34.03                               | 16.79 | -0.001        | -37.496         | 14.90    | 4.17     |
| 3000.0000        | -14.62                  | -14.69                  | -32.43                               | -31.68                               | 13.52 | -0.015        | -35.198         | 13.63    | 4.18     |
| 3500.0000        | -13.19                  | -13.31                  | -30.17                               | -29.75                               | 10.24 | 0.019         | -36.355         | 12.79    | 4.19     |
| 4000.0000        | -12.04                  | -12.23                  | -28.13                               | -28.14                               | 8.39  | 0.019         | -38.318         | 11.90    | 4.18     |
| 4500.0000        | -10.79                  | -11.09                  | -26.37                               | -26.30                               | 6.41  | 0.011         | -39.156         | 11.45    | 4.13     |
| 5000.0000        | -9.94                   | -10.33                  | -24.99                               | -24.83                               | 5.35  | 0.011         | -43.704         | 10.95    | 4.11     |
| 5500.0000        | -8.97                   | -9.49                   | -23.51                               | -23.31                               | 4.40  | 0.024         | -41.071         | 10.45    | 4.09     |
| 6000.0000        | -8.21                   | -8.84                   | -22.26                               | -22.06                               | 3.82  | 0.028         | -38.980         | 9.93     | 4.11     |
| 6500.0000        | -7.41                   | -8.19                   | -21.17                               | -20.87                               | 3.27  | 0.025         | -36.002         | 9.66     | 4.09     |
| 7000.0000        | -6.75                   | -7.66                   | -19.85                               | -19.67                               | 2.94  | 0.029         | -38.253         | 8.95     | 4.15     |
| 7500.0000        | -6.16                   | -7.19                   | -18.62                               | -18.54                               | 2.69  | 0.034         | -44.914         | 8.11     | 4.35     |
| 8000.0000        | -5.64                   | -6.76                   | -17.60                               | -17.59                               | 2.48  | 0.041         | -52.360         | 7.48     | 4.48     |
| 8500.0000        | -5.17                   | -6.40                   | -16.82                               | -16.81                               | 2.30  | 0.038         | -43.933         | 6.94     | 4.71     |
| 9000.0000        | -4.71                   | -6.06                   | -16.18                               | -16.03                               | 2.11  | 0.041         | -38.048         | 6.65     | 4.83     |
| 9500.0000        | -4.13                   | -5.61                   | -15.56                               | -15.61                               | 1.97  | 0.036         | -45.414         | 6.36     | 5.07     |
| 10000.0000       | -3.68                   | -5.31                   | -15.03                               | -14.94                               | 1.83  | 0.035         | -41.367         | 6.22     | 5.13     |
| 10500.0000       | -2.85                   | -4.73                   | -14.41                               | -14.28                               | 1.64  | 0.038         | -36.934         | 6.34     | 5.22     |
| 11000.0000       | -2.26                   | -4.30                   | -13.78                               | -13.72                               | 1.52  | 0.039         | -40.336         | 6.26     | 5.27     |
| 11500.0000       | -1.68                   | -3.90                   | -13.20                               | -13.21                               | 1.43  | 0.044         | -41.533         | 6.28     | 5.25     |
| 12000.0000       | -1.53                   | -3.82                   | -12.86                               | -12.82                               | 1.41  | 0.049         | -46.170         | 6.04     | 5.29     |
| 12500.0000       | -1.29                   | -3.67                   | -12.68                               | -12.69                               | 1.38  | 0.051         | -40.248         | 6.14     | 5.25     |
| 13000.0000       | -1.13                   | -3.65                   | -12.75                               | -12.71                               | 1.37  | 0.041         | -43.093         | 6.20     | 5.43     |
| 13500.0000       | -0.94                   | -3.56                   | -12.88                               | -12.86                               | 1.35  | 0.044         | -43.034         | 6.27     | 5.68     |
| 14000.0000       | -0.70                   | -3.47                   | -13.21                               | -13.13                               | 1.33  | 0.039         | -32.688         | 6.62     | 5.89     |
| 14500.0000       | -0.17                   | -3.27                   | -13.51                               | -13.33                               | 1.28  | 0.023         | -31.483         | 7.15     | 6.19     |
| 15000.0000       | 0.15                    | -3.09                   | -13.65                               | -13.66                               | 1.27  | 0.025         | -40.622         | 7.39     | 6.42     |
| 15500.0000       | 0.09                    | -3.15                   | -13.95                               | -13.92                               | 1.27  | 0.025         | -38.265         | 7.51     | 6.52     |
| 16000.0000       | -0.24                   | -3.31                   | -14.06                               | -14.00                               | 1.30  | 0.024         | -39.573         | 7.50     | 6.32     |
| 16500.0000       | -0.48                   | -3.42                   | -14.06                               | -14.05                               | 1.32  | 0.030         | -46.013         | 7.22     | 6.35     |
| 17000.0000       | -1.43                   | -4.00                   | -14.34                               | -14.24                               | 1.44  | 0.028         | -37.600         | 6.51     | 6.40     |
| 17500.0000       | -2.60                   | -4.72                   | -14.76                               | -14.60                               | 1.63  | 0.027         | -33.228         | 5.85     | 6.31     |
| 18000.0000       | -3.60                   | -5.38                   | -15.08                               | -15.09                               | 1.87  | 0.024         | -44.662         | 5.47     | 6.01     |



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

**V<sub>DS</sub> = 0 V, V<sub>GS</sub> = -2.5 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        | 0.993           | -13.3  | 0.041           | 75.0   | 0.041           | 75.0   | 0.986           | -15.4  |
| 2500.0000        | 0.987           | -17.7  | 0.051           | 70.4   | 0.052           | 70.7   | 0.982           | -19.9  |
| 3000.0000        | 0.982           | -22.2  | 0.062           | 65.3   | 0.062           | 65.9   | 0.979           | -24.7  |
| 3500.0000        | 0.978           | -26.7  | 0.072           | 60.3   | 0.072           | 59.3   | 0.974           | -29.7  |
| 4000.0000        | 0.975           | -30.7  | 0.080           | 55.1   | 0.080           | 54.9   | 0.969           | -34.6  |
| 4500.0000        | 0.970           | -34.4  | 0.088           | 50.6   | 0.087           | 50.1   | 0.968           | -39.2  |
| 5000.0000        | 0.968           | -37.5  | 0.095           | 46.0   | 0.095           | 46.5   | 0.967           | -43.4  |
| 5500.0000        | 0.965           | -40.3  | 0.103           | 42.9   | 0.102           | 42.5   | 0.965           | -47.5  |
| 6000.0000        | 0.966           | -43.4  | 0.111           | 40.2   | 0.111           | 40.2   | 0.957           | -50.8  |
| 6500.0000        | 0.963           | -45.9  | 0.123           | 37.4   | 0.122           | 37.0   | 0.961           | -54.9  |
| 7000.0000        | 0.959           | -48.8  | 0.136           | 33.0   | 0.137           | 32.9   | 0.955           | -59.3  |
| 7500.0000        | 0.947           | -52.6  | 0.149           | 27.8   | 0.148           | 28.0   | 0.950           | -63.5  |
| 8000.0000        | 0.944           | -57.6  | 0.164           | 23.0   | 0.162           | 23.0   | 0.939           | -68.5  |
| 8500.0000        | 0.939           | -63.2  | 0.180           | 17.7   | 0.178           | 17.9   | 0.930           | -74.1  |
| 9000.0000        | 0.928           | -69.2  | 0.196           | 12.0   | 0.196           | 12.0   | 0.920           | -80.4  |
| 9500.0000        | 0.922           | -75.5  | 0.212           | 5.5    | 0.211           | 5.2    | 0.915           | -87.9  |
| 10000.0000       | 0.913           | -81.2  | 0.224           | -1.0   | 0.224           | -1.2   | 0.903           | -95.8  |
| 10500.0000       | 0.912           | -86.2  | 0.240           | -7.0   | 0.239           | -7.3   | 0.899           | -104.5 |
| 11000.0000       | 0.913           | -91.2  | 0.255           | -13.1  | 0.257           | -13.3  | 0.906           | -111.8 |
| 11500.0000       | 0.909           | -96.6  | 0.271           | -19.6  | 0.273           | -20.1  | 0.906           | -119.1 |
| 12000.0000       | 0.904           | -102.7 | 0.289           | -27.3  | 0.288           | -27.0  | 0.913           | -126.6 |
| 12500.0000       | 0.905           | -109.8 | 0.307           | -34.7  | 0.305           | -34.6  | 0.900           | -134.7 |
| 13000.0000       | 0.897           | -118.1 | 0.324           | -43.7  | 0.324           | -43.6  | 0.887           | -143.4 |
| 13500.0000       | 0.884           | -127.9 | 0.339           | -53.8  | 0.338           | -53.7  | 0.879           | -153.5 |
| 14000.0000       | 0.869           | -139.1 | 0.346           | -64.3  | 0.343           | -64.5  | 0.874           | -164.8 |
| 14500.0000       | 0.868           | -150.3 | 0.345           | -76.4  | 0.345           | -76.3  | 0.875           | -177.8 |
| 15000.0000       | 0.866           | -161.6 | 0.333           | -88.1  | 0.334           | -88.3  | 0.877           | 169.0  |
| 15500.0000       | 0.867           | -172.6 | 0.311           | -99.3  | 0.313           | -98.7  | 0.882           | 156.9  |
| 16000.0000       | 0.872           | 177.4  | 0.294           | -109.3 | 0.289           | -109.7 | 0.897           | 146.1  |
| 16500.0000       | 0.885           | 166.6  | 0.269           | -119.0 | 0.268           | -119.1 | 0.905           | 136.8  |
| 17000.0000       | 0.870           | 153.6  | 0.251           | -129.3 | 0.246           | -129.4 | 0.926           | 128.7  |
| 17500.0000       | 0.871           | 139.7  | 0.226           | -140.8 | 0.227           | -140.2 | 0.927           | 122.1  |
| 18000.0000       | 0.855           | 124.6  | 0.198           | -151.5 | 0.198           | -152.4 | 0.923           | 115.3  |

**AMPLIFIER PARAMETERS**

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

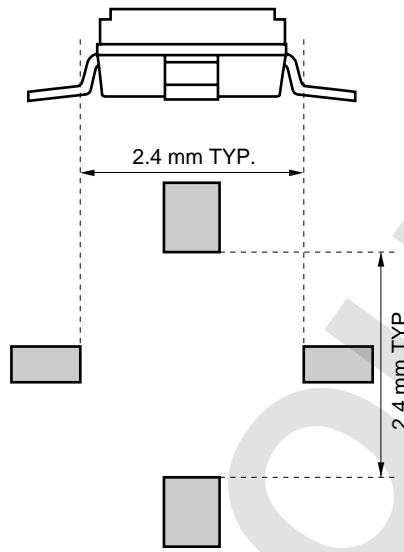
| FREQUENCY<br>MHz | GU <sub>max</sub><br>dB | GA <sub>max</sub><br>dB | S <sub>21</sub>   <sup>2</sup><br>dB | S <sub>12</sub>   <sup>2</sup><br>dB | K    | Delay<br>nsec | Mason's U<br>dB | G1<br>dB | G2<br>dB |
|------------------|-------------------------|-------------------------|--------------------------------------|--------------------------------------|------|---------------|-----------------|----------|----------|
| 2000.0000        | 6.59                    | -1.81                   | -27.69                               | -27.72                               | 1.09 | 0.037         | -41.579         | 18.66    | 15.62    |
| 2500.0000        | 4.66                    | -2.29                   | -25.78                               | -25.76                               | 1.14 | 0.026         | -37.612         | 15.91    | 14.53    |
| 3000.0000        | 4.16                    | -2.37                   | -24.10                               | -24.15                               | 1.16 | 0.028         | -32.931         | 14.46    | 13.79    |
| 3500.0000        | 3.77                    | -2.45                   | -22.90                               | -22.89                               | 1.16 | 0.027         | -30.070         | 13.70    | 12.97    |
| 4000.0000        | 3.27                    | -2.57                   | -21.96                               | -21.97                               | 1.18 | 0.029         | -46.684         | 13.12    | 12.12    |
| 4500.0000        | 3.06                    | -2.59                   | -21.12                               | -21.17                               | 1.19 | 0.025         | -36.484         | 12.23    | 11.95    |
| 5000.0000        | 3.35                    | -2.46                   | -20.43                               | -20.42                               | 1.16 | 0.026         | -36.357         | 11.96    | 11.82    |
| 5500.0000        | 3.47                    | -2.35                   | -19.76                               | -19.86                               | 1.16 | 0.017         | -32.225         | 11.57    | 11.66    |
| 6000.0000        | 3.33                    | -2.41                   | -19.10                               | -19.12                               | 1.16 | 0.015         | -46.847         | 11.70    | 10.73    |
| 6500.0000        | 4.33                    | -2.04                   | -18.22                               | -18.27                               | 1.12 | 0.015         | -34.379         | 11.37    | 11.18    |
| 7000.0000        | 4.16                    | -2.07                   | -17.36                               | -17.24                               | 1.11 | 0.025         | -30.925         | 10.93    | 10.58    |
| 7500.0000        | 3.50                    | -2.14                   | -16.54                               | -16.59                               | 1.13 | 0.029         | -37.284         | 9.90     | 10.14    |
| 8000.0000        | 3.26                    | -2.14                   | -15.68                               | -15.80                               | 1.13 | 0.026         | -31.894         | 9.67     | 9.28     |
| 8500.0000        | 3.09                    | -2.15                   | -14.91                               | -15.00                               | 1.13 | 0.030         | -33.177         | 9.30     | 8.70     |
| 9000.0000        | 2.57                    | -2.31                   | -14.16                               | -14.16                               | 1.14 | 0.032         | -60.851         | 8.60     | 8.13     |
| 9500.0000        | 2.64                    | -2.21                   | -13.47                               | -13.52                               | 1.13 | 0.036         | -37.108         | 8.25     | 7.87     |
| 10000.0000       | 2.13                    | -2.37                   | -13.01                               | -13.00                               | 1.15 | 0.036         | -47.342         | 7.79     | 7.36     |
| 10500.0000       | 2.50                    | -2.17                   | -12.40                               | -12.44                               | 1.13 | 0.033         | -36.990         | 7.72     | 7.18     |
| 11000.0000       | 3.39                    | -1.82                   | -11.86                               | -11.80                               | 1.09 | 0.034         | -33.577         | 7.81     | 7.45     |
| 11500.0000       | 3.74                    | -1.63                   | -11.33                               | -11.29                               | 1.07 | 0.036         | -31.606         | 7.62     | 7.45     |
| 12000.0000       | 4.38                    | -1.32                   | -10.79                               | -10.80                               | 1.05 | 0.043         | -33.886         | 7.37     | 7.79     |
| 12500.0000       | 4.37                    | -1.23                   | -10.26                               | -10.32                               | 1.04 | 0.041         | -33.321         | 7.42     | 7.22     |
| 13000.0000       | 4.00                    | -1.27                   | -9.79                                | -9.78                                | 1.04 | 0.050         | -40.261         | 7.08     | 6.71     |
| 13500.0000       | 3.67                    | -1.30                   | -9.38                                | -9.42                                | 1.05 | 0.056         | -36.338         | 6.61     | 6.44     |
| 14000.0000       | 3.15                    | -1.46                   | -9.22                                | -9.30                                | 1.06 | 0.059         | -31.349         | 6.12     | 6.25     |
| 14500.0000       | 3.16                    | -1.48                   | -9.24                                | -9.24                                | 1.06 | 0.067         | -48.824         | 6.09     | 6.31     |
| 15000.0000       | 2.83                    | -1.66                   | -9.54                                | -9.52                                | 1.07 | 0.065         | -38.005         | 6.02     | 6.35     |
| 15500.0000       | 2.44                    | -1.92                   | -10.14                               | -10.09                               | 1.10 | 0.062         | -31.130         | 6.05     | 6.53     |
| 16000.0000       | 2.65                    | -1.85                   | -10.64                               | -10.80                               | 1.10 | 0.055         | -27.440         | 6.21     | 7.08     |
| 16500.0000       | 2.64                    | -2.01                   | -11.41                               | -11.43                               | 1.11 | 0.054         | -47.034         | 6.65     | 7.40     |
| 17000.0000       | 2.61                    | -1.99                   | -12.01                               | -12.17                               | 1.12 | 0.057         | -28.001         | 6.14     | 8.48     |
| 17500.0000       | 1.77                    | -2.46                   | -12.90                               | -12.88                               | 1.16 | 0.064         | -33.848         | 6.18     | 8.49     |
| 18000.0000       | -0.05                   | -3.35                   | -14.05                               | -14.06                               | 1.31 | 0.059         | -33.797         | 5.71     | 8.29     |

## NOISE PARAMETERS

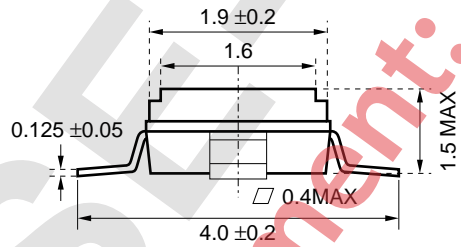
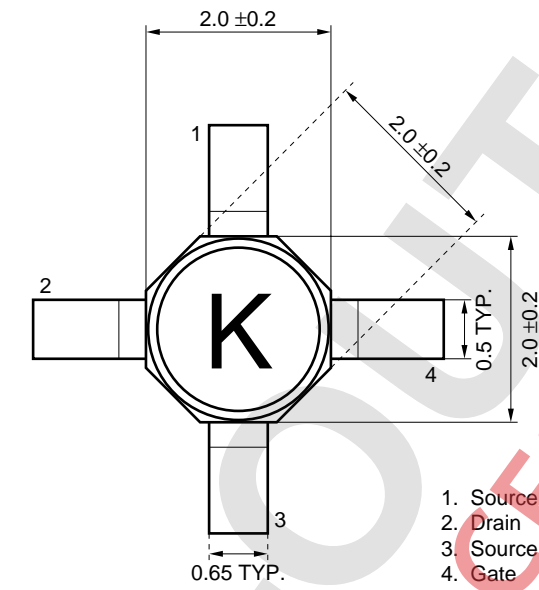
 $V_{DS} = 2\text{ V}$ ,  $I_D = 10\text{ mA}$ 

| Freq. (GHz) | NF <sub>min.</sub> (dB) | G <sub>a</sub> (dB) | Γ <sub>opt</sub> |      | Rn/50 |
|-------------|-------------------------|---------------------|------------------|------|-------|
|             |                         |                     | MAG.             | ANG. |       |
| 2.0         | 0.25                    | 21.2                | 0.94             | 12   | 0.38  |
| 4.0         | 0.26                    | 19.5                | 0.80             | 26   | 0.33  |
| 6.0         | 0.28                    | 18.2                | 0.66             | 44   | 0.26  |
| 8.0         | 0.30                    | 16.2                | 0.50             | 68   | 0.18  |
| 10.0        | 0.32                    | 14.7                | 0.38             | 97   | 0.11  |
| 12.0        | 0.34                    | 13.5                | 0.29             | 133  | 0.09  |
| 14.0        | 0.42                    | 12.9                | 0.27             | 177  | 0.08  |
| 16.0        | 0.56                    | 12.3                | 0.33             | -129 | 0.11  |
| 18.0        | 0.72                    | 11.9                | 0.39             | -82  | 0.23  |

TYPICAL MOUNT PAD LAYOUT



PACKAGE DIMENSIONS (Unit: mm)



PHASER  
Drop-In Replacement: CE3572K2

**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 <sup>Note</sup> : None | IR30-00-1                    |
| Partial Heating  | Pin temperature: 230 °C<br>Time: 10 seconds or less (per pin row)<br>Exposure limit <sup>Note</sup> : None                           |                              |

**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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