

C to Ku BAND LOW NOISE AMPLIFIER
N-CHANNEL GaAs MES FET

FEATURES

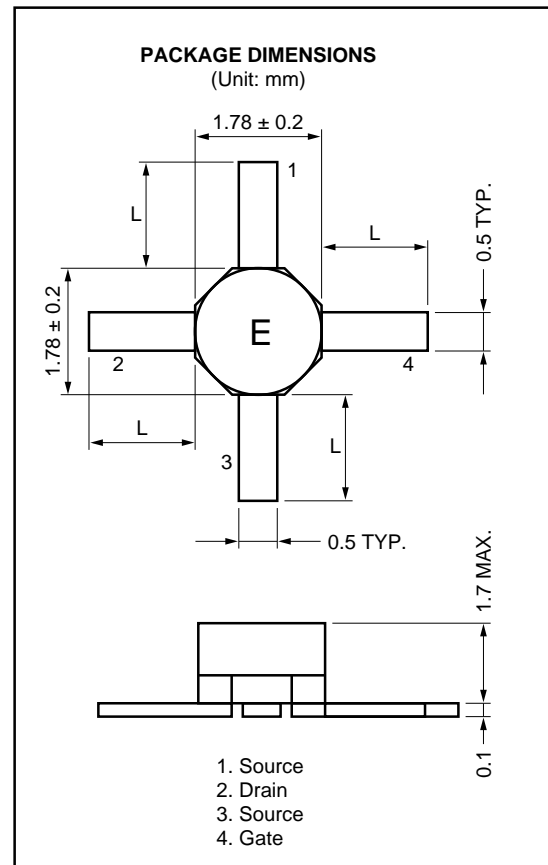
- Low noise figure & High associated gain
NF = 1.6 dB TYP., Ga = 9.0 dB TYP. at f = 12 GHz
- Gate length: $L_g = 0.3 \mu\text{m}$
- Gate width : $W_g = 280 \mu\text{m}$

ORDERING INFORMATION

| PART NUMBER | SUPPLYING FORM | LEAD LENGTH | MARKING |
|-------------|-------------------------------|------------------|---------|
| NE76084-SL | STICK | L = 1.7 mm MIN. | E |
| NE76084-T1 | Tape & reel 1000 pcs./reel | L = 1.0 ± 0.2 mm | |
| NE76084-T1A | Tape & reel 5000 pcs./reel | L = 1.0 ± 0.2 mm | |

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

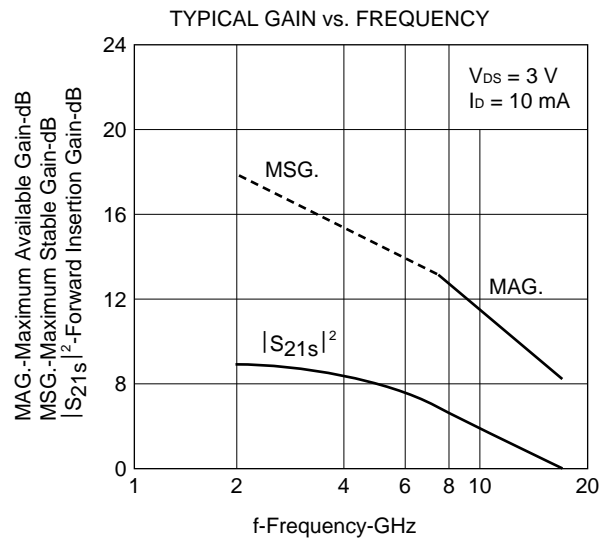
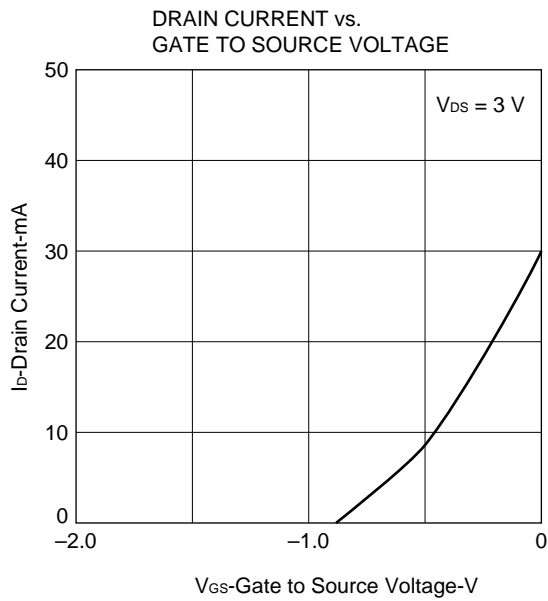
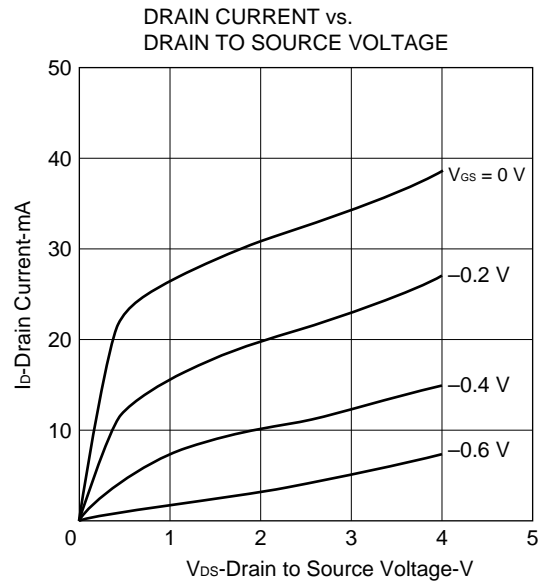
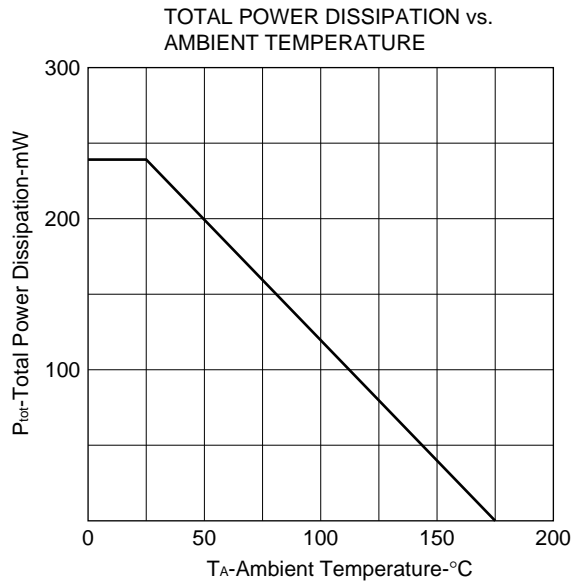
| | | | |
|-------------------------|------------------|------------------|----|
| Drain to Source Voltage | V _{DS} | 5.0 | V |
| Gate to Source Voltage | V _{GS} | -3.0 | V |
| Gate to Drain Voltage | V _{GD} | -5.0 | V |
| Drain Current | I _D | I _{DSS} | mA |
| Total Power Dissipation | P _{tot} | 240 | mW |
| Channel Temperature | T _{ch} | 175 | °C |
| Storage Temperature | T _{stg} | -65 to +175 | °C |



ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

| PART NUMBER | | NE76084 | | | NE76084-2.4 | | | UNIT | TEST CONDITIONS |
|-------------------------------|----------------------|---------|------|------|-------------|------|------|------|---|
| PACKAGE CODE | | 84 | | | 84 | | | | |
| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | | |
| Gate to Source Leak Current | I _{gso} | | | 10 | | | 10 | μA | V _{GS} = -4 V |
| Saturated Drain Current | I _{DSS} | 15 | 30 | 50 | 15 | 30 | 50 | mA | V _{DS} = 3 V, V _{GS} = 0 V |
| Gate to Source Cutoff Voltage | V _{GS(off)} | -0.5 | -0.8 | -3.0 | -0.5 | -0.8 | -3.0 | V | V _{DS} = 3 V, I _{DS} = 100 μA |
| Transconductance | g _m | 30 | 40 | 70 | 30 | 40 | 70 | mS | V _{DS} = 3 V, I _{DS} = 10 mA |
| Noise Figure | NF | | 1.6 | 1.8 | | 1.8 | 2.4 | dB | V _{DS} = 3 V, I _{DS} = 10 mA |
| Associated Gain | Ga | 8.0 | 9.0 | | 8.0 | 9.0 | | dB | f = 12 GHz |

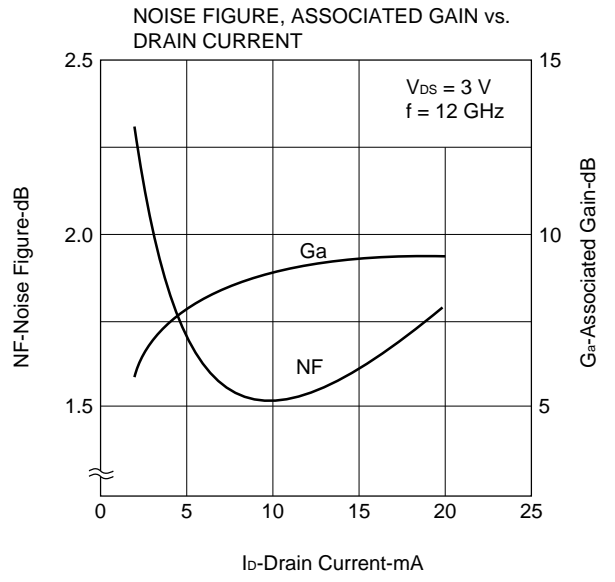
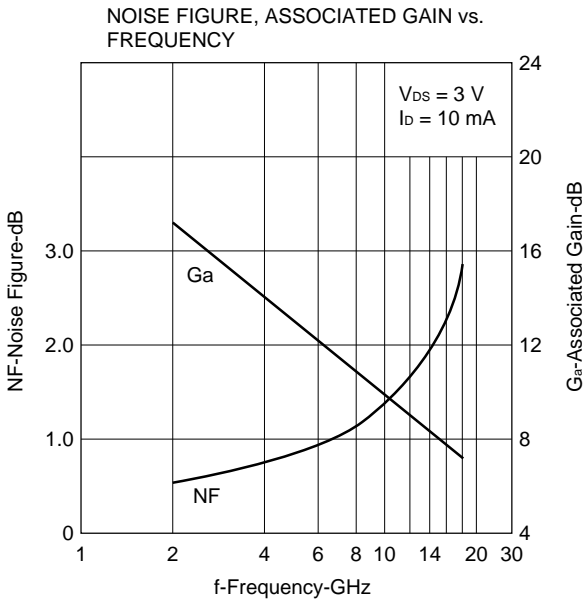
TYPICAL CHARACTERISTICS (T_A = 25 °C)



Gain Calculations

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

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

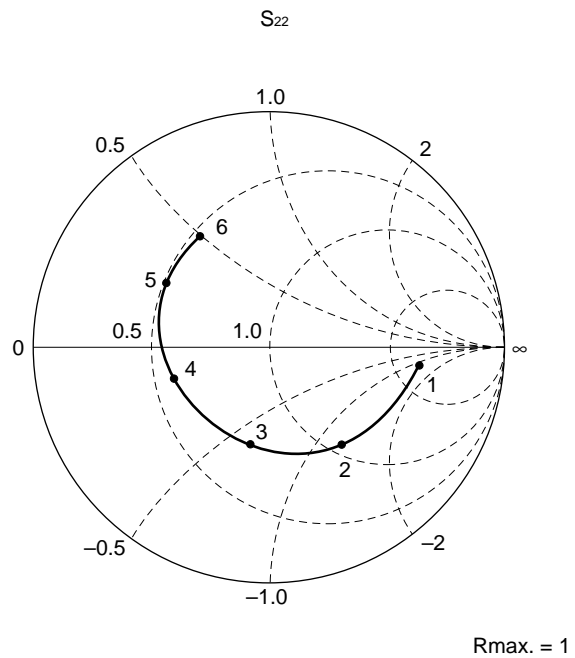
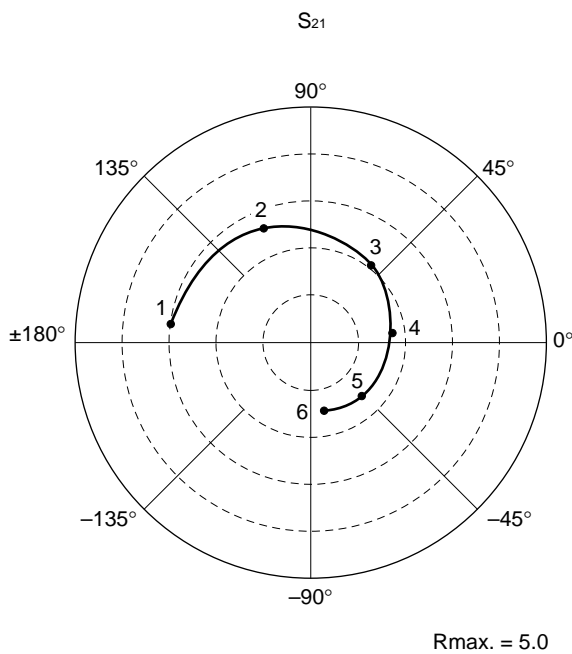
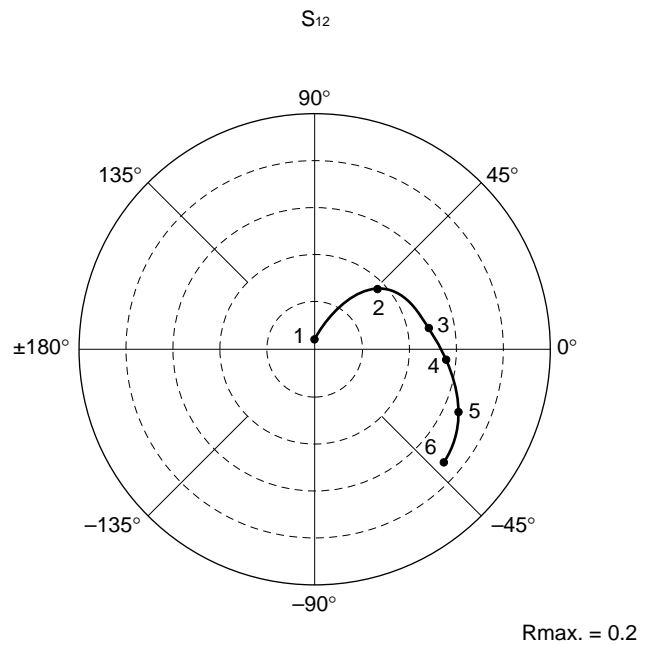
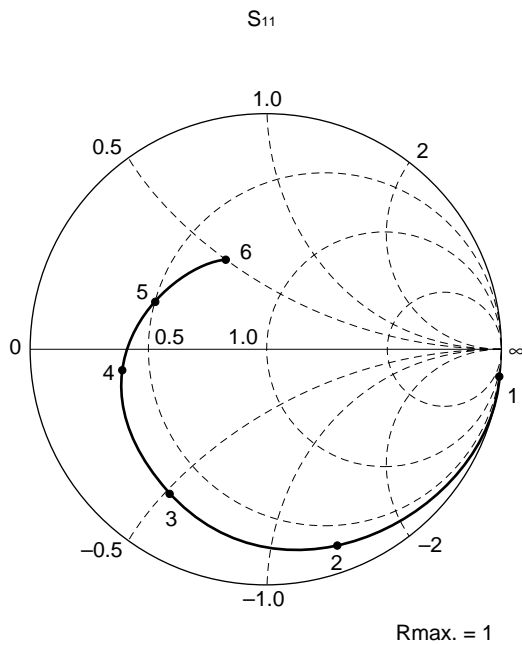


S-PARAMETERS

$V_{DS} = 3\text{ V}$, $I_D = 10\text{ mA}$

START 500 MHz, STOP 18 GHz, STEP 500 MHz

- Marker
 1: 500 MHz
 2: 4 GHz
 3: 8 GHz
 4: 12 GHz
 5: 16 GHz
 6: 18 GHz



S-PARAMETERS

V_{DS} = 3 V, I_D = 10 mA

| FREQUENCY MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) |
| 500 | 0.997 | -9.4 | 2.917 | 170.5 | 0.012 | 83.2 | 0.620 | -7.0 |
| 1000 | 0.989 | -18.5 | 2.890 | 161.3 | 0.023 | 76.9 | 0.615 | -13.9 |
| 1500 | 0.977 | -27.6 | 2.853 | 152.2 | 0.034 | 70.6 | 0.607 | -20.8 |
| 2000 | 0.960 | -36.4 | 2.802 | 143.4 | 0.044 | 64.6 | 0.596 | -27.4 |
| 2500 | 0.942 | -44.9 | 2.749 | 134.8 | 0.053 | 58.9 | 0.584 | -34.1 |
| 3000 | 0.923 | -53.4 | 2.694 | 126.3 | 0.062 | 53.3 | 0.571 | -40.8 |
| 3500 | 0.902 | -61.7 | 2.638 | 118.0 | 0.069 | 47.9 | 0.556 | -47.2 |
| 4000 | 0.879 | -69.8 | 2.571 | 109.8 | 0.075 | 42.8 | 0.541 | -54.0 |
| 4500 | 0.857 | -77.6 | 2.507 | 101.8 | 0.081 | 38.0 | 0.524 | -60.4 |
| 5000 | 0.834 | -85.3 | 2.437 | 94.1 | 0.085 | 33.5 | 0.509 | -67.0 |
| 5500 | 0.812 | -92.8 | 2.371 | 86.4 | 0.089 | 29.2 | 0.493 | -73.8 |
| 6000 | 0.792 | -99.9 | 2.299 | 79.1 | 0.092 | 25.0 | 0.482 | -80.5 |
| 6500 | 0.773 | -106.6 | 2.231 | 71.9 | 0.094 | 21.5 | 0.468 | -87.4 |
| 7000 | 0.756 | -113.0 | 2.167 | 65.0 | 0.095 | 18.2 | 0.460 | -93.9 |
| 7500 | 0.742 | -119.1 | 2.106 | 58.4 | 0.096 | 15.2 | 0.452 | -100.6 |
| 8000 | 0.728 | -124.8 | 2.054 | 51.9 | 0.097 | 12.7 | 0.446 | -107.1 |
| 8500 | 0.714 | -130.3 | 2.004 | 45.5 | 0.098 | 10.3 | 0.443 | -113.7 |
| 9000 | 0.700 | -135.8 | 1.963 | 39.2 | 0.099 | 8.2 | 0.438 | -119.7 |
| 9500 | 0.687 | -141.1 | 1.927 | 33.0 | 0.100 | 6.3 | 0.438 | -126.2 |
| 10000 | 0.673 | -146.6 | 1.891 | 26.7 | 0.102 | 4.3 | 0.435 | -133.0 |
| 10500 | 0.658 | -151.9 | 1.858 | 20.5 | 0.102 | 2.2 | 0.437 | -139.7 |
| 11000 | 0.644 | -157.4 | 1.826 | 14.3 | 0.104 | 0.5 | 0.436 | -146.8 |
| 11500 | 0.630 | -162.9 | 1.792 | 8.1 | 0.105 | -1.3 | 0.438 | -153.5 |
| 12000 | 0.617 | -168.4 | 1.765 | 2.1 | 0.107 | -3.0 | 0.441 | -160.4 |
| 12500 | 0.605 | -173.7 | 1.736 | -4.0 | 0.108 | -4.6 | 0.446 | -167.3 |
| 13000 | 0.592 | -179.1 | 1.710 | -10.0 | 0.110 | -6.6 | 0.456 | -173.8 |
| 13500 | 0.580 | 175.6 | 1.688 | -16.0 | 0.113 | -8.5 | 0.461 | -180.0 |
| 14000 | 0.566 | 170.3 | 1.671 | -22.2 | 0.116 | -10.6 | 0.473 | 174.2 |
| 14500 | 0.552 | 164.7 | 1.658 | -28.2 | 0.119 | -13.3 | 0.480 | 167.8 |
| 15000 | 0.537 | 158.9 | 1.642 | -34.6 | 0.123 | -15.9 | 0.494 | 162.3 |
| 15500 | 0.519 | 152.7 | 1.634 | -41.0 | 0.126 | -19.1 | 0.505 | 155.5 |
| 16000 | 0.500 | 146.2 | 1.617 | -47.5 | 0.130 | -22.6 | 0.514 | 149.9 |
| 16500 | 0.480 | 139.0 | 1.607 | -54.2 | 0.134 | -26.4 | 0.526 | 143.4 |
| 17000 | 0.461 | 131.4 | 1.596 | -61.0 | 0.138 | -30.9 | 0.536 | 136.9 |
| 17500 | 0.441 | 123.4 | 1.579 | -67.9 | 0.142 | -35.5 | 0.551 | 130.9 |
| 18000 | 0.422 | 114.4 | 1.566 | -75.1 | 0.145 | -40.6 | 0.561 | 124.2 |

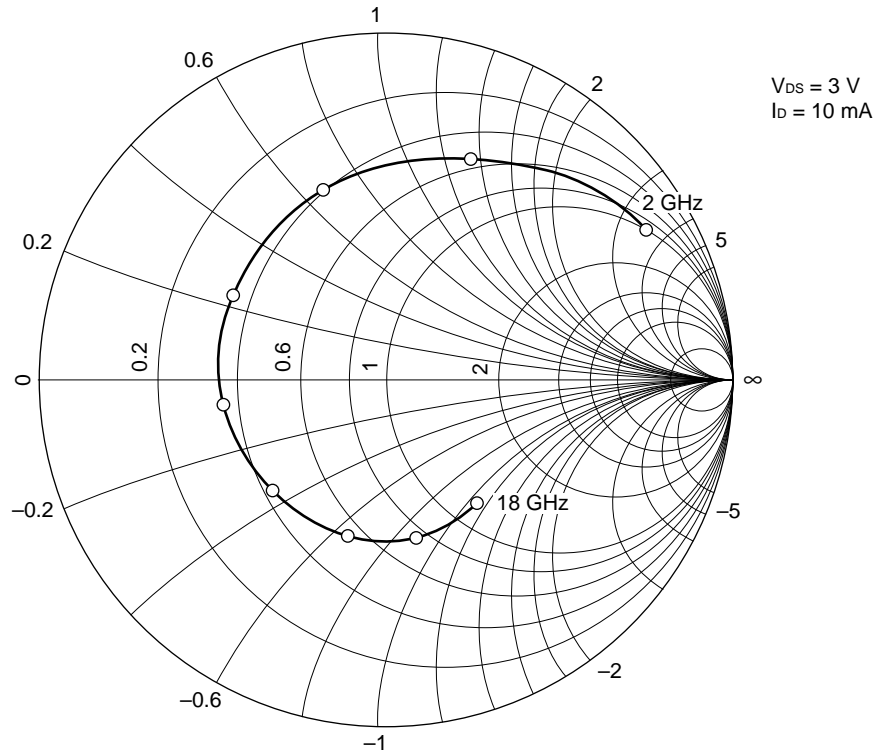
AMP. PARAMETERS

$V_{DS} = 3\text{ V}$, $I_D = 10\text{ mA}$

| FREQUENCY MHz | GUmax. dB | GAmix. dB | S ₂₁ ² dB | S ₁₂ ² dB | K | Delay ns | Mason's U dB | G1 dB | G2 dB |
|------------------|--------------|--------------|--------------------------------------|--------------------------------------|------|-------------|-----------------|----------|----------|
| 500 | 33.02 | | 9.30 | -38.67 | 0.08 | 0.051 | 35.846 | 21.62 | 2.10 |
| 1000 | 27.83 | | 9.22 | -32.75 | 0.13 | 0.051 | 32.671 | 16.55 | 2.06 |
| 1500 | 24.50 | | 9.11 | -29.44 | 0.19 | 0.051 | 30.124 | 13.39 | 2.00 |
| 2000 | 21.87 | | 8.95 | -27.17 | 0.25 | 0.049 | 27.520 | 11.02 | 1.91 |
| 2500 | 20.08 | | 8.78 | -25.50 | 0.30 | 0.048 | 26.456 | 9.48 | 1.81 |
| 3000 | 18.61 | | 8.61 | -24.22 | 0.35 | 0.047 | 25.794 | 8.29 | 1.71 |
| 3500 | 17.32 | | 8.42 | -23.24 | 0.40 | 0.046 | 24.722 | 7.30 | 1.60 |
| 4000 | 16.14 | | 8.20 | -22.47 | 0.46 | 0.046 | 23.833 | 6.44 | 1.50 |
| 4500 | 15.13 | | 7.98 | -21.87 | 0.52 | 0.044 | 23.043 | 5.75 | 1.39 |
| 5000 | 14.20 | | 7.74 | -21.38 | 0.57 | 0.043 | 22.182 | 5.16 | 1.30 |
| 5500 | 13.39 | | 7.50 | -21.02 | 0.63 | 0.043 | 21.487 | 4.68 | 1.21 |
| 6000 | 12.66 | | 7.23 | -20.76 | 0.69 | 0.041 | 20.671 | 4.28 | 1.15 |
| 6500 | 12.01 | | 6.97 | -20.55 | 0.75 | 0.040 | 20.221 | 3.96 | 1.08 |
| 7000 | 11.44 | | 6.72 | -20.42 | 0.80 | 0.038 | 19.654 | 3.69 | 1.03 |
| 7500 | 10.93 | | 6.47 | -20.33 | 0.85 | 0.037 | 19.247 | 3.47 | 0.99 |
| 8000 | 10.48 | | 6.25 | -20.25 | 0.90 | 0.036 | 18.929 | 3.27 | 0.96 |
| 8500 | 10.09 | | 6.04 | -20.16 | 0.94 | 0.035 | 18.779 | 3.10 | 0.95 |
| 9000 | 9.71 | | 5.86 | -20.08 | 0.99 | 0.035 | 18.378 | 2.93 | 0.93 |
| 9500 | 9.40 | 11.93 | 5.70 | -19.99 | 1.02 | 0.034 | 18.331 | 2.77 | 0.93 |
| 10000 | 9.06 | 11.21 | 5.53 | -19.85 | 1.06 | 0.035 | 17.972 | 2.62 | 0.91 |
| 10500 | 8.76 | 10.66 | 5.38 | -19.80 | 1.10 | 0.034 | 17.332 | 2.47 | 0.92 |
| 11000 | 8.47 | 10.23 | 5.23 | -19.68 | 1.13 | 0.034 | 16.850 | 2.33 | 0.91 |
| 11500 | 8.19 | 9.84 | 5.07 | -19.58 | 1.17 | 0.034 | 16.224 | 2.20 | 0.92 |
| 12000 | 7.96 | 9.56 | 4.94 | -19.45 | 1.19 | 0.033 | 15.764 | 2.08 | 0.94 |
| 12500 | 7.73 | 9.29 | 4.79 | -19.32 | 1.21 | 0.034 | 15.275 | 1.98 | 0.96 |
| 13000 | 7.55 | 9.13 | 4.66 | -19.16 | 1.21 | 0.033 | 15.008 | 1.87 | 1.01 |
| 13500 | 7.37 | 8.95 | 4.55 | -18.96 | 1.22 | 0.033 | 14.639 | 1.78 | 1.04 |
| 14000 | 7.24 | 8.85 | 4.46 | -18.75 | 1.21 | 0.034 | 14.410 | 1.68 | 1.10 |
| 14500 | 7.11 | 8.76 | 4.39 | -18.50 | 1.20 | 0.034 | 14.165 | 1.58 | 1.14 |
| 15000 | 7.00 | 8.73 | 4.31 | -18.21 | 1.17 | 0.035 | 14.046 | 1.48 | 1.21 |
| 15500 | 6.91 | 8.67 | 4.27 | -17.98 | 1.16 | 0.036 | 13.754 | 1.36 | 1.28 |
| 16000 | 6.76 | 8.52 | 4.17 | -17.70 | 1.16 | 0.036 | 13.255 | 1.25 | 1.33 |
| 16500 | 6.67 | 8.47 | 4.12 | -17.43 | 1.14 | 0.037 | 12.958 | 1.14 | 1.41 |
| 17000 | 6.57 | 8.39 | 4.06 | -17.18 | 1.13 | 0.038 | 12.636 | 1.04 | 1.47 |
| 17500 | 6.48 | 8.34 | 3.97 | -16.98 | 1.12 | 0.038 | 12.338 | 0.94 | 1.57 |
| 18000 | 6.39 | 8.24 | 3.90 | -16.78 | 1.12 | 0.040 | 11.963 | 0.85 | 1.64 |

NOISE PARAMETERS

< $\Gamma_{opt.}$ vs. frequency>



Start 2 GHz, Stop 18 GHz, Step 2 GHz

<Noise Parameter>

$V_{DS} = 3 V, I_D = 10 mA$

| Freq. (dB) | NF _{MIN.} (dB) | Ga (dB) | $\Gamma_{opt.}$ | | Rn/50 |
|---------------|----------------------------|------------|-----------------|-------------|-------|
| | | | MAG. | ANG. (deg.) | |
| 2.0 | 0.55 | 16.9 | 0.88 | 31 | 0.51 |
| 4.0 | 0.62 | 14.0 | 0.72 | 69 | 0.46 |
| 6.0 | 0.81 | 12.3 | 0.60 | 107 | 0.37 |
| 8.0 | 1.10 | 11.0 | 0.52 | 148 | 0.32 |
| 10.0 | 1.25 | 10.1 | 0.46 | -175 | 0.26 |
| 12.0 | 1.60 | 9.0 | 0.45 | -138 | 0.21 |
| 14.0 | 1.90 | 8.1 | 0.45 | -104 | 0.17 |
| 16.0 | 2.25 | 7.6 | 0.45 | -78 | 0.11 |
| 18.0 | 2.75 | 7.0 | 0.48 | -52 | 0.10 |

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

<TYPES OF SURFACE MOUNT DEVICE>

For more details, refer to our document “SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL” (C10535E).

| Soldering process | Soldering conditions | Symbol |
|------------------------|--|---------|
| Infrared ray reflow | Peak package’s surface temperature: 230 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 1, Exposure limit*: None | IR30-00 |
| Partial heating method | Terminal temperature: 230 °C or below, Flow time: 10 seconds or below, Exposure limit*: None | |

* Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Note Do not apply more than a single process at once, except for “Partial heating method”.

PRECAUTION Avoid high static voltage and electric fields, because this device is MES FET with GaAs shottky barrier gate.

Caution

**The Great Care must be taken in dealing with the devices in this guide.
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the Japanese law concerned.
Keep the law concerned and so on, especially in case of removal.**

[MEMO]

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.